



THE ASSAM GAZETTE

অসাধাৰণ

EXTRAORDINARY

প্ৰাপ্ত কৰ্তৃত্ব দ্বাৰা প্ৰকাশিত

PUBLISHED BY THE AUTHORITY

নং 266 দিশপুৰ, মঙ্গলবাৰ, 9 জুলাই, 2024, 18 আশ্বিন, 1946 (শক)

No. 266 Dispur, Tuesday, 9th July, 2024, 18th Ashadha, 1946 (S. E.)

GOVERNMENT OF ASSAM

ORDERS BY THE GOVERNOR

DEPARTMENT OF HOUSING AND URBAN AFFAIRS

NOTIFICATION

The 26th September, 2023

ECF No. 376601/294.- In exercise of the powers conferred by the section 9 and sub-section (1) of section 10 of the Assam Town & Country Planning Act. 1959 (as amended) and (Assam Act II of 1960) read with sub-rule (1) of Rule 3 of the Assam Town and Country Planning (Publication of Master Plan and Zoning Regulations) Rules 1962, the Governor of Assam is pleased to publish the following notice regarding the publication of Draft Master plan for Dhakuakhana-2041.

Notice for the Publication of Draft Master Plan for Dhakuakhana-2041

1. It is notified that the Draft Master plan for Dhakuakhana prepared by the Directorate of Town & Country Planning, Assam, under section 9 of the Assam Town & Country Planning Act 1959 (As amended), as described in the schedule below is hereby published.
2. Any person or persons affected by the Draft Master plan may submit their objection or opinion in writing to the Director, Town & Country Planning, Dispur, Guwahati-6 within two months from the date of publication.
3. The Draft Master plan for Dhakuakhana with all relevant papers and maps may be inspected free of Cost during office hours at the Office the Director, Town & Country Planning, Assam, Dispur, Cuwahati-6, the Deputy Director, Town & Country Planning, District Office- North Lakhimpur, the Circle office, Dhakuaklunil Revenue Circle, Dhakuilkhilna, Office of the Chairman, Dhakuakhana Municipal Board, Dhakuakhana. Copies of the Draft Master plan for Dhakuakhana are available at the office of the Deputy Director, Town & Country Planning, North Lakhimpur for sale on payment.

SCHEDULE**Schedule of Dhakuakhana Planning Area**

Schedule of the Master Plan for Dhakuakhana town includes the Dhakuakhana Municipal area of 12.58 sq km and Master Plan area measuring 61.24 sq km. The details of the schedule of the planning area are as follows :

District : Lakhimpur, Assam

Sub-Division : Dhakuakhana, Assam

Municipal Area : 12.58 sq km

Master Plan Area : 61.24 sq km

List of Villages of Dhakuakhana Planning Area

S.No.	Village	Mouza	Dag
1	1 No. Ghilaguri Part 2	Dhakuakhana	Entire
2	1 No. Ghilaguri Part 3	Dhakuakhana	Entire
3	2 No. Ghilaguri Part 2	Dhakuakhana	Entire
4	2 No. Gilaguri Part 1	Dhakuakhana	Entire
5	Bahpara Part 1	Dhakuakhana	Entire
6	Bahpara Part 2	Dhakuakhana	Entire
7	Bantow Chamah Pathar	Dhakuakhana	Entire
8	Bantow Gaon	Dhakuakhana	Entire
9	Bantow Pathar	Dhakuakhana	Entire
10	Barhula Chapari	Dhakuakhana	Entire
11	Bhaluka Guri Chapori	Dhakuakhana	Entire
12	Dakhin Chapori	Dhakuakhana	Entire
13	Dighala Chapori	Dhakuakhana	Entire
14	Dighala Diloidari	Dhakuakhana	Entire
15	Dulia Perabari Part	Dhakuakhana	Entire
16	Gohain Handique	Dhakuakhana	Entire
17	Gohainbari	Dhakuakhana	Entire
18	Gohainbari Pathar	Dhakuakhana	Entire
19	Jarani Chapari Part 1	Dhakuakhana	Entire
20	Jiamaria Gaon	Dhakuakhana	Entire
21	Kalakata Chetia	Dhakuakhana	Entire
22	Kuhimari Chapori	Dhakuakhana	Entire
23	N.C. Bantow (Non-Cadastral)	Dhakuakhana	Entire
24	Narayanpur Chapari Part-1	Dhakuakhana	Entire
25	Narayanpur Chapari Part-2	Dhakuakhana	Entire
26	NC Simaliguri (Non-Cadastral)	Dhakuakhana	Entire
27	Pithial	Dhakuakhana	Entire
28	Tella Chapori	Dhakuakhana	Entire

Description of Boundaries

North : Mahemari Pathar, Mahemari Gaon, Na Ali, Dulia Gaon, Goroimari Chapari

South : Burmur Dang Dhara, No.1 Krishnapur, No.-2 Krishnapur, khubung Chapori

East : No.1 Kelkei, NC Chekani Dang Dhara, Medhusuti Miri

West : NC Borjan Pathar, Borjan Patahr, Namrupia Jalbhari.

KAVITHA PADMANABHAN,

Commissioner & Secretary to the Government of Assam,
Department of Housing and Urban Affairs.

CHAPTER 1: INTRODUCTION

1.1 Introduction

In northeast India, most of the towns are small and medium towns. In the recent times, these towns have witnessed an unprecedented growth and development increase in the share of the urban population. Most towns in the state of Assam lack necessary infrastructure and basic services to support their growth potential, and many lack effective administrative capacity to man infrastructure. Therefore, efficient, and effective planning of these areas becomes paramount. Planning is intended to focus on establishing regional linkages, enhancing economic prosperity, reducing inequality and inequity among citizens, and reducing regional inequalities.

Dhakuakhana is one such town located in Assam in Lakhimpur district. Dhakuakhana town ranks second in terms of area and fourth in terms of population share in the district. As per the GIS-based digitisation of cadastral maps, the town occupies a municipal area of 12.58 sq km and has a population of 13,502 as per the Census of India, 2011. To ensure the planned development of the town, Master Plan of Dhakuakhana is proposed to be prepared for the horizon year 2041. A total of 28 villages surrounding Dhakuakhana town have been included in the planning area making up a cumulative area of 61.24 sq km having a total population of 31,557 (**see Figure 1.1**).

A master plan is a legal document for developing an urban area prepared for a specific time period. The validity of a master plan is for a specific period and once that period expires it needs revisions and modifications. During the Eleventh Five Year Plan, it was proposed that a master plan may be prepared for priority towns and growth centres covering about 33 urban centres. There are 97 towns in Assam, out of which the Final Master Plan was prepared for 28 towns and the Draft Master Plan was prepared for 10 towns. Moreover, at present, 45 Draft Master Plans are under preparation by the District Offices of the department of Town and Country Planning. Additionally, the Directorate of Town and Country Planning has taken up the initiative to prepare 25 GIS-based Master Plans in Assam.

The master plan for Dhakuakhana town has not been prepared so far. The town lacks many social and physical infrastructural facilities, economic opportunities, and regional

resources. Therefore, a critical analysis of all development sectors of the town followed by a careful formulation of plans and policies to achieve constant and holistic growth of the town shall be proposed. So, to start with, this master plan aims to study all the existing development sectors of the town, both qualitatively and quantitatively, to identify major planning issues, to come up with implementable solutions and make planning proposals and recommendations to achieve stated development goals for Dhakuakhana town in the Master Plan for Dhakuakhana, 2041.

1.2 Dhakuakhana Planning Area 2041 and its Schedule

Dhakuakhana Planning Area (DPA) constitutes the Dhakuakhana Municipal Area and the surrounding 28 villages. Total Dhakuakhana Planning Area comprises of 61.24 sq km.

1.2.1 Schedule of Dhakuakhana Planning Area

Schedule of the Master Plan for Dhakuakhana town includes the Dhakuakhana Municipal area of 12.58 sq km and Master Plan area measuring 61.24 sq km. The details of the schedule of the planning area are as follows:

District	: Lakhimpur, Assam
Sub-Division	: Dhakuakhana, Assam
Municipal Area	: 12.58 sq km
Master Plan Area	: 61.24 sq km

1.2.2 Description of Boundaries

North: Mahemari Pathar, Mahemari Gaon, Na Ali, Dulia Gaon, Goroimari Chapari

South: Alimur Dang Dhara, No. 1 Krishnapur, No.2 Krishnapur, Khubung Chapori

East: No.1 Kelkeli, NC Chekani Dang Dhara, Medhusuti Miri

West: NC Borjan Pathar, Borjan Pathar, Namrupia Jalbhari

Dhakuakhana town is in the Lakhimpur district, with the Lakhimpur sub-division to its west, the Dhemaji subdivision to its north, and Majuli Island to its south. Geographically, it lies between 27.60 to 27.35 ° N latitude and 94.24 to 94.42 ° E longitude. The

predominant religion in the area is Hinduism. However, there are also people of other faiths and religious beliefs, such as Christianity, Islam, and tribal sects. Mising Tribe also makes a significant share of the population of the town. The soil of the town is mainly alluvial and sandy. The riverbeds are generally higher than the level of land in many parts of the town. The native languages of Dhakuakhana town are Assamese and Bengali with the predominance of the Assamese language.

A contour map has been generated at the intervals of three metres for the entire planning area. Based on this, levels of all major roads have been calculated from the mean sea level. The zero point of Dhakuakhana has also been fixed at the post office near Chariyali (**see Figure 1.2**).

Source: SPA New Delhi (2022).

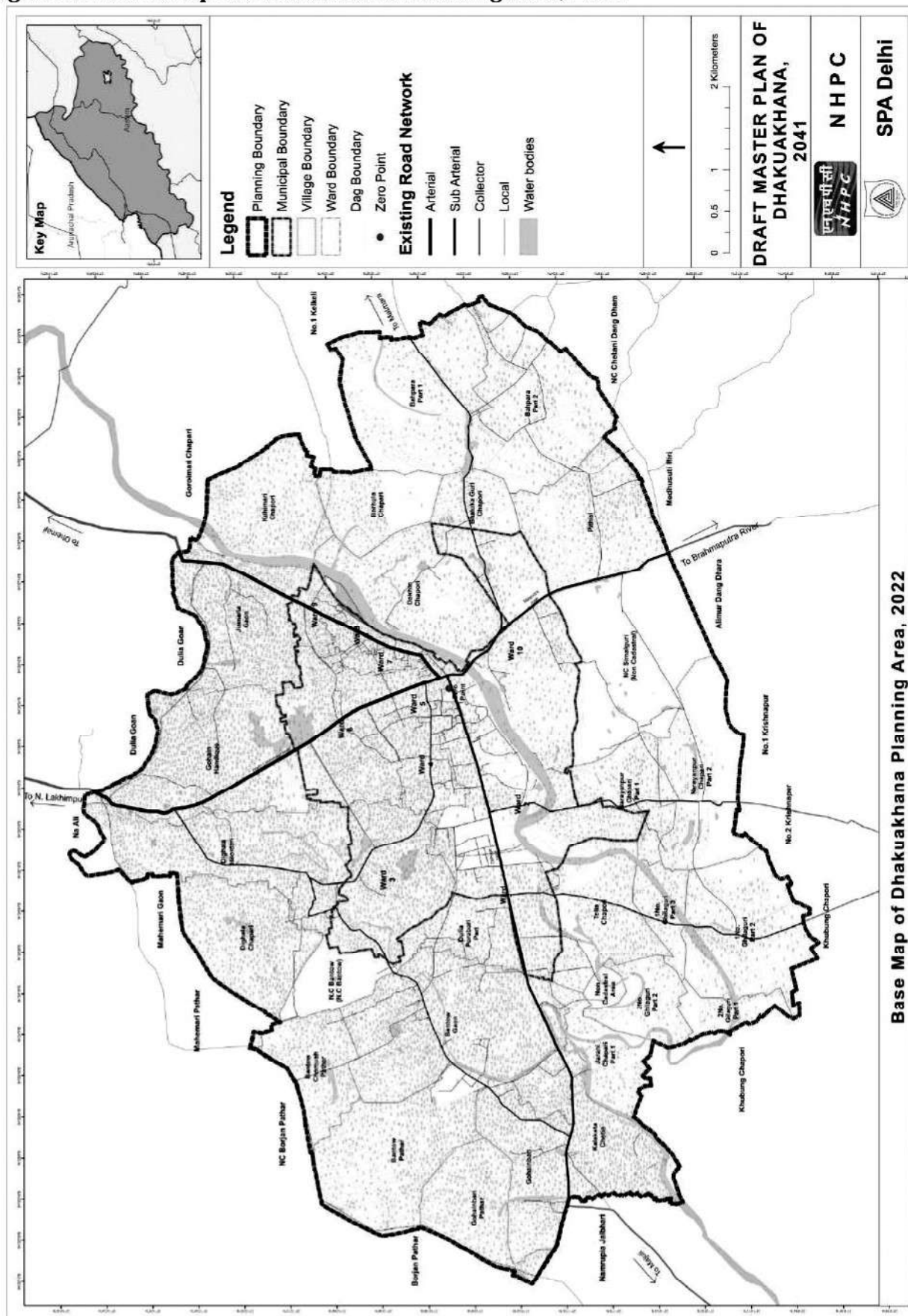
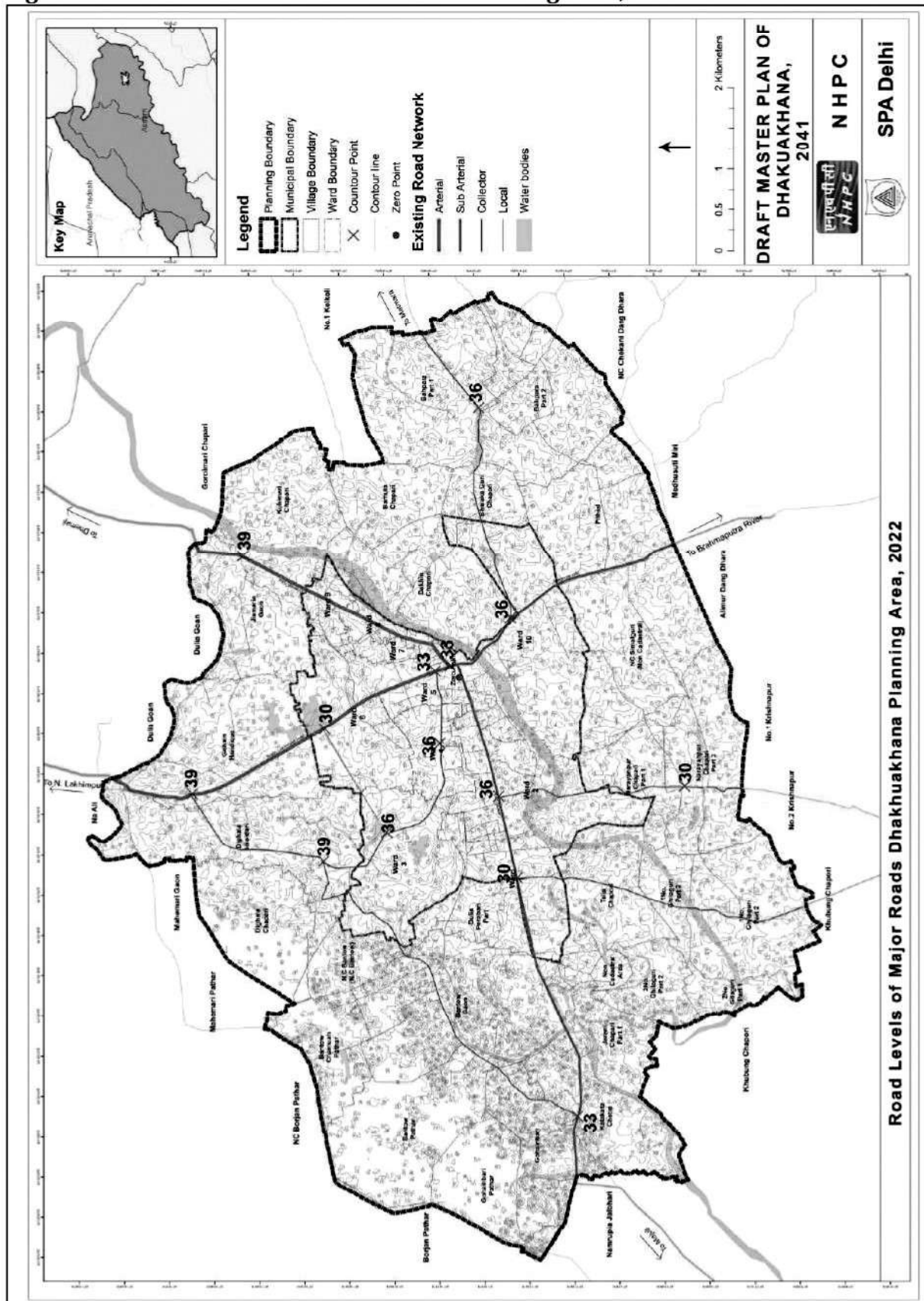


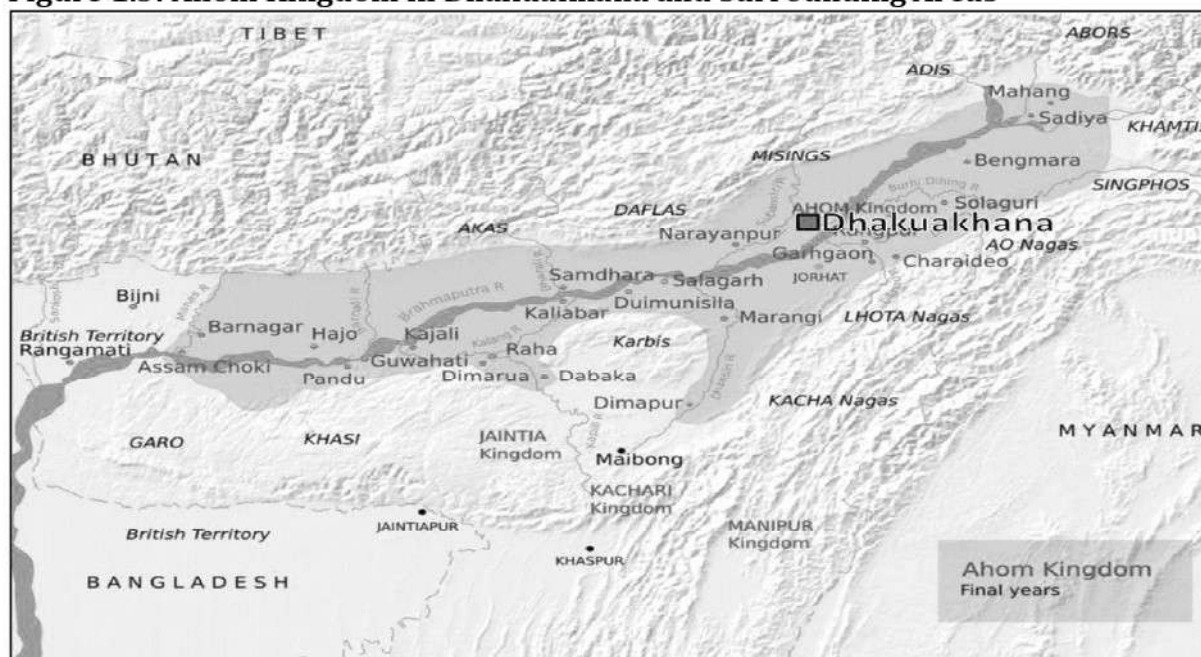
Figure 1.2: Road Levels of Dhakuakhana Planning Area, 2022

Source: SPA, New Delhi (2022).

1.3 Brief History of Dhakuakhana

Historically, it is believed that around 1240 AD, when the first King of the Ahom region, Chow Chukafa established his capital at a place named Haboong in the neighbouring district of Dhemaji, many Tai-Ahom people came and settled in Dhakuakhana.

Figure 1.3: Ahom Kingdom in Dhakuakhana and Surrounding Areas



Source: The Last Days of Ahom Monarchy, (Baruah, 1993).

Due to the perennial floods in the Dhemaji area, the King shifted the capital from Haboong to Sibsagar. After this, the area came under the rule of Chutias which continued from 1223 to 1523 A.D. During 1523 A.D. the then Ahom King Chuhung-Moong is believed to have attacked and killed the Chutia king Natipal and as a result the area again came under the rule of Ahoms (see **Figure 1.3**). The entire Dhakuakhana area is believed to be originally inhabited by various indigenous tribes like Mising, Sonowal Kachari, Deori, and Laloong. In addition to this, various other tribes like Ahom, Rabha, Tai - Khamti, Konch, Keot, etc. are known to have migrated to the area during different periods. Like the rest of Assam, Dhakuakhana is still home to a diverse range of ethnic tribes, including Chutia, Mising, Ahom, Deori, Koch, and others with diverse traditions and cultural histories.

1.4 Project Background

The Core Group of Assam in its eighth meeting held on 11 September 2019 asked the NHPC to engage the School of Planning and Architecture, New Delhi for the preparation

of Regional Plans for the Lakhimpur and Dhemaji districts in Assam. In addition to this, NHPC also engaged SPA, New Delhi to prepare four master plans as nodes for the fast-paced development of these two districts.

Accordingly, NHPC vide letter of 21 October 2019 invited faculty members from the School of Planning and Architecture, New Delhi to have preliminary discussions with the district administration, peoples' representatives, and other stakeholders as suggested by the concerned authorities. Another meeting was held on 26 November 2019 between Honourable Member of Legislative Assembly, Dhemaji; Deputy Commissioners of Dhemaji and Lakhimpur; Chief Executive Councillor, Mising Autonomous Council; concerned district officers; concerned Panchayat heads; Chairperson, Town Committee; and other stakeholders with faculty members of SPA New Delhi in the presence of Executive Director, Subansiri Lower HE Project and other officers of the NHPC. During the said meeting, after detailed discussions and deliberations, people's representatives, and district administration of Dhemaji and Lakhimpur recommended that SPA New Delhi should be engaged in the preparation of two district development plans and four master plans. These are District Development Plans for Dhemaji and Lakhimpur districts and Master Plans for North Lakhimpur town, Dhakuakhana town, Dhemaji town, and Silapathar town.

1.5 Contents of Master Plan

The Master Plan is a statutory document for a planning area. Proposals on land use, circulation, number, location of facilities, etc. are proposed in the master plan of a town. The scale of the Master Plan may vary from 1: 5,000 to 1:10,000. It is a major tool for urban land management, providing detailed land use allocations for the sustainable development of a city or town. Most master plans are made for 20-year periods, in phases of five years with periodic reviews and revisions. The general contents of the master plan include Land Use Plan, Zoning Plan, Transportation Plan, Public Utilities Plan, Development Controls and Master Plan Report.

1.6 Vision and Objectives of Dhakuakhana Master Plan, 2041

The major goal of the Dhakuakhana Master Plan, 2041 is to ensure development of Dhakuakhana town with a focus on the economic development and sustainability. Broadly, the Master Plan will concentrate on the following aspects of sustainability:

- **Economic Sustainability** in terms of ensuring livelihoods and economic growth of the area, development of transportation and other infrastructure; and decent housing to all.
- **Social Sustainability** in terms of future needs of people in the different stages of their lives for meeting the needs of people of varying abilities; and favourable environments for community living.
- **Environmental Sustainability** in terms of conservation of energy; conservation of water; reduction of pollution; safe disposal of waste; and conservation of green cover and water bodies.

The main objective of the master plan is to ensure the development of the town as per the development potential of various sectors of the town. Master Plan also intends to

1.7 Scope of the Work

The planning boundary was already delineated by the concerned authority including municipal boundary and nearby village areas to expand the town for the projected population for the year 2041, which will be useful for faster implementation of the development proposals. The scope of the work includes a proposed land use map of that area considering the future land demand for the projected population for the year 2041. The analysis is performed on different sectors at the ward level, municipal area level, and planning area level based on different sectors included in the master plan preparation. Broad aspects covered for the preparation of a Master Plan are as given below:

- Statements of goals and objectives
- Collection of data and information
- Analysis of data and information
- Identification of issues and potentials of developments
- Preparation of alternative scenarios of developments
- Selection of an alternative
- Implementation or actualization
- Monitoring and feedback

1.8 Methodology

The Master plan Dhakuakhana for 2041 will be prepared according to the following specific methodology.

a) Preparation of Geo-Referenced Base Maps: Based upon the existing base maps or revenue maps available with the government authorities, SPA New Delhi will prepare geo-referenced maps required for the preparation of the Master Plan.

b) Field Surveys and Data Collection: Field surveys have been conducted to collect necessary data for identifying issues and problems as well as resource potentials for the development of the town. The survey particularly focussed in detail on major economic activities, broad land uses, major transportation and communication networks, infrastructure facilities, shelter, heritage, and tourism, and environmental, ecology and conservation. Detailed secondary data collection and field surveys were already conducted on the following aspects to identify potentialities and growth trends in the area.

- Existing land use survey of the town.
- Traffic and transportation surveys to quantify travel need road network, public transport networks, origin and destination survey, rail, and other connectivity, etc.
- Surveys for physical infrastructure including water, power, solid waste management, sewerage system, and other sanitation issues, etc.
- Study of a disposal system for solid wastes management including hospital wastes.
- Survey of important tourism and heritage sites.
- Mapping and analyses of environmental features like water bodies, natural channels, forests, plantations, low-lying areas, agricultural lands, etc.
- Collection of secondary information from the Census of India.
- Surveys have been undertaken to understand demographic and socio-economic and physical and social infrastructure.
- Collection of data on the existing institutional framework, funding, and implementation agencies to identify gaps was conducted.

c) Preparation of land use maps and data analysis: Base map is updated to prepare the existing land use maps for the town and planning area. All the above-mentioned

data collected from primary or secondary sources are compiled and analysed to identify trends, potentials, and problems of the town followed by projections on aspects like demography, land utilization, socio-economic conditions, traffic and transportation requirements, the requirement of infrastructure, and community facilities, housing, trade and commerce, economic base, industries, and environmental concerns.

Development and spatial planning proposals for Dhakuakhana town will focus on the following aspects:

- Land use plan will be made for the planned utilization of land in the future for residential, commercial, public semi-public, industry, transportation, heritage, ecologically sensitive areas, and other uses.
- Housing shall contain proposals related to the existing housing shortage and future housing needs and strategies for overall improvement in housing.
- Traffic and transportation proposals shall contain long and short-term strategies including proposals for new roads and missing links, widening of the existing roads and connectivity of missing links, location of terminal facilities, and public transportation system.
- Industry and trade proposals shall include the identification of industrial areas, their locations, and types of industries through the analysis of future growth and worker participation.
- Proposals for social infrastructure including education, health, fire services, etc. shall be made.
- Proposals for physical infrastructure like water supply and distribution plan, sanitation, sewerage plan with locations of sewage treatment plants, solid waste management plans, energy plans, etc. shall be also made.
- Environment Management Plan shall specify environmental improvements, renewal and rehabilitation proposals, and development of passive and active open spaces and plantations.
- The draft master plan will be submitted to NHPC, which in turn may send this plan to various stakeholders for their comments.
- The final draft master plan shall be prepared and submitted to the NHPC after incorporating comments of the NHPC, district authorities, and other stakeholders.

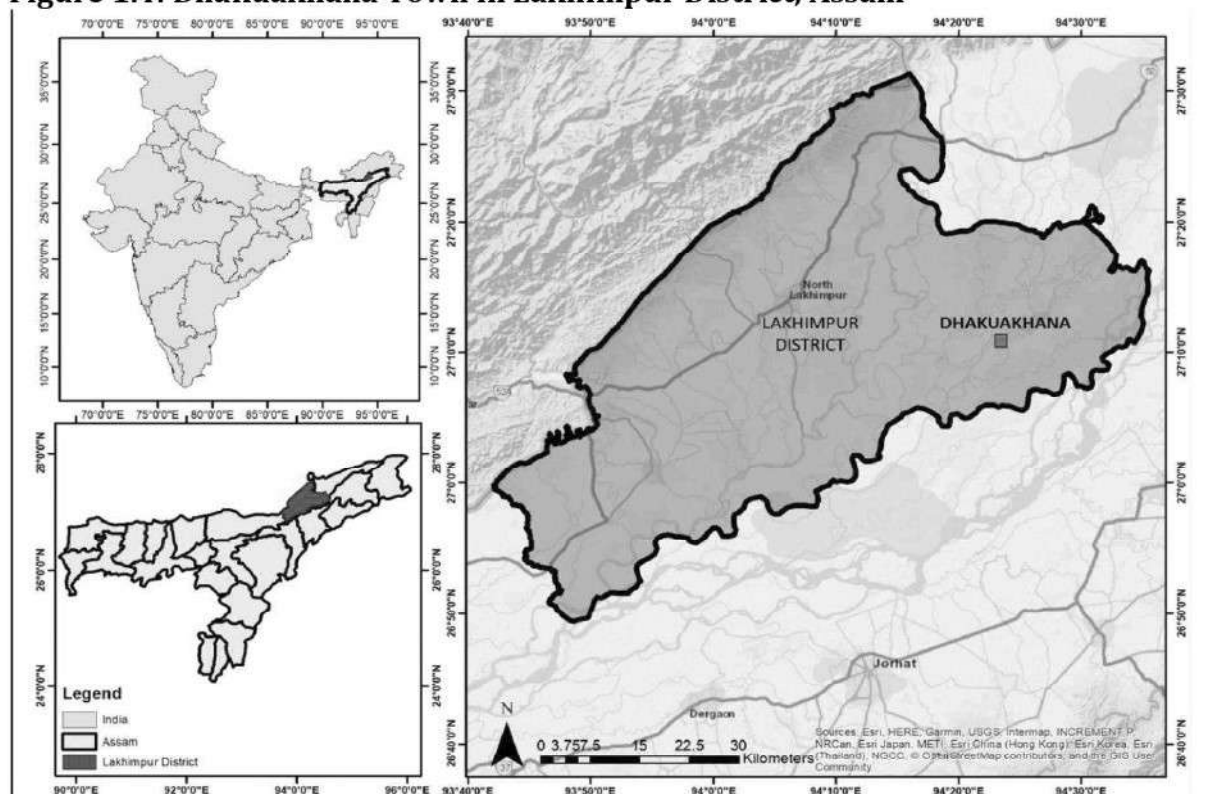
1.9 Deliverables

Deliverables for a master plan would include physical development proposals on the following aspects:

- Proposed and the existing land use map for the projected population of the town for the year 2041.
- Existing gaps and future requirements of infrastructure, housing, commercial, public and semi-public facilities for the proposed population.
- Formulation of policies, programs, and governing structures for plan implementation.

1.10 Physical Setting

Regional setting includes locational context and connectivity of Dhakuakhana town with surrounding major cities, towns, and activity areas. The connectivity is described in terms of roads, railways, waterways, and airways. Regional connectivity also elucidates the intra-connectivity of the sub-division and other towns of Lakhimpur district. Dhakuakhana town is one of the oldest towns in Assam. The town occupies an area of 12.58 sq km and has a total urban population of 13,502 as per the Census of India, 2011. The planning area is 61.24 sq km and has a total population of 31,557 people. Dhakuakhana town is in the Lakhimpur district with the Lakhimpur sub-division to its west, Dhemaji subdivision to its north, and Majuli Island to its south. Geographically, the town lies between 27.60° to 27.35° N latitude and 94.24° to 94.42° E longitude (**Figure 1.4**).

Figure 1.4: Dhakuakhana Town in Lakhimpur District, Assam

Source: SPA Delhi, (2022).

1.11 Road Connectivity and Transportation

1.11.1 Road Connectivity

No National Highways are passing through the planning area. State Highway 42 passes through the town connecting North Lakhimpur to Dhakuakhana via Ghilamora. The Dhemaji road has been proposed to be converted to a state highway in the future as an extension of SH 22. The Dhakuakhana-College Road that goes to Majuli Island meets with SH21 at Natun Kulamora Chapori NC. The SH22 further connects the town to Dhemaji and Gogamukh. The SH21 connects to Dhakuakhana with neighbouring towns of Majuli and North Lakhimpur. The connectivity of Dhakuakhana town to nearby major towns is satisfactory at present but could be improved. The district headquarters in North Lakhimpur can be reached via roadways crossing through Ghilamara. There are two bus stands in Dhakuakhana at present, one for Assam State Transport Corporation Buses and one for private buses. Shared taxi services to Dhemaji, Ghilamara, and Lakhimpur are available from an informal bus stop at Chariyali in the town. The bus services are available from 5:30 am to 5:30 pm with a frequency of two buses per hour.

approximately. The availability of public transport is poor after 5:30 pm with hardly any direct means of transport available for neighbouring towns.

Guwahati is located 388 kilometres away from Dhakuakhana via NH27, and NH715. The district headquarters at North Lakhimpur is located at 77.7 kilometres via NH15 and Gogamukh road. The distance between Dhakuakhana and other major towns in the state is given in **Table 1.1**.

Table 1.1: Connectivity of Dhakuakhana Town, 2011

Nearest city with population of one lakh and more	Nearest city with population of five lakh and more
Jorhat at 85.9 km	Guwahati at 388 km

Source: Census of India (2011).

The roads in the town are constructed by Public Works Department. The total length of roads constructed till 31 March 2018 in Dhakuakhana Town is 44.736 km. Out of these 4.59 km are WBM or WMM roads, 11.32 kilometres are Bituminous / Cement Concrete Roads, and 26.8 kilometres are un-surfaced roads as shown in **Table 1.2**.

Table 1.2: Length of Pucca and Kutcha Road in Dhakuakhana Town

Total Length of Roads (in kilometres)	Surfaced Roads Length in Kilometres			Un-surfaced Roads in Kilometres
42.736	WBM/WMM	BT/CC	Total	Total
	4.590	11.318	15.908	26.828

Source: Dhakuakhana Municipal Board (2022).

1.11.2 Rail Connectivity

There is no railway line passing through Dhakuakhana town. The nearest railway station is Bordoloni which is at 31 km from the town. Dhemaji railway station is at 47 km, North Lakhimpur Railway Station is at 75 km, and Dibrugarh Railway Station is at 97 km from the town.

1.11.3 Air Connectivity

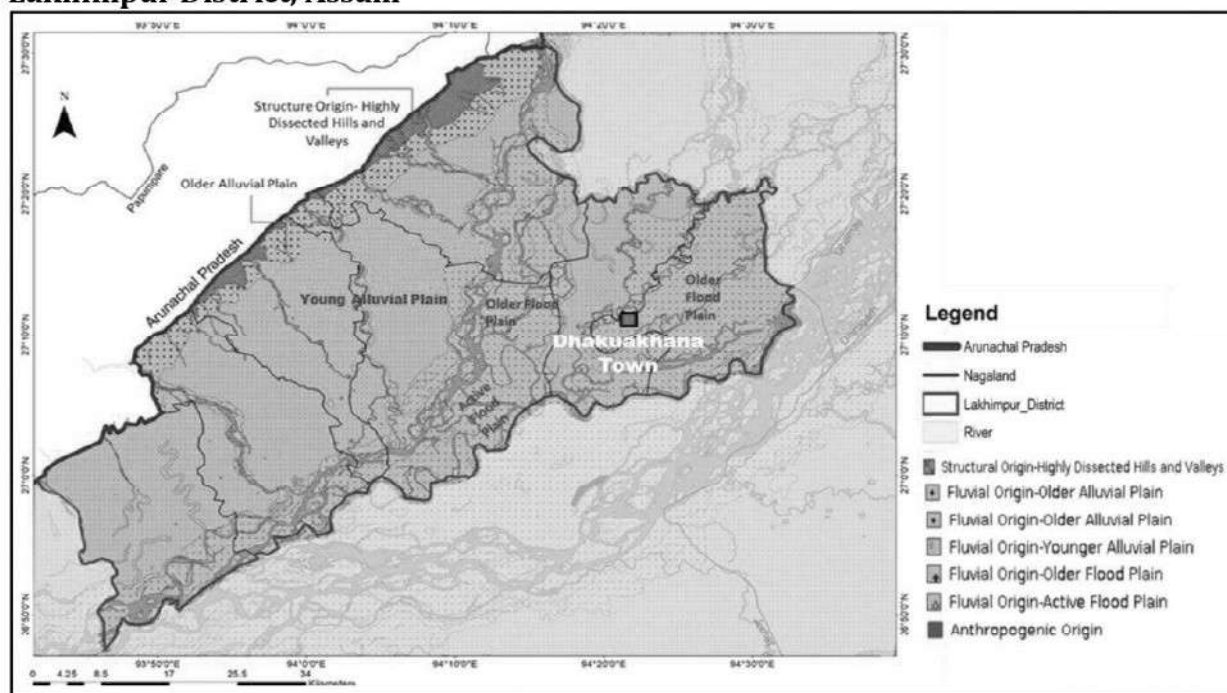
The nearest airport is Lilabari Airport in North Lakhimpur located at 75.9 kilometres from Dhakuakhana town. It connects to Kolkata and Guwahati. The airport is equipped with a night landing facility and the runway is being modified to operate larger aircraft.

Another nearby airport is Dibrugarh airport, which is at 91.5 km approximately from the town.

1.12 Geomorphology

Geo-morphologically the area can be classified mainly into four divisions like structural hills, piedmont zone (developed adjacent to the Himalayan foothills define the northern limit of the Gangetic plains), alluvial plain, and flood plain. The piedmont zone is gravel-dominated while the alluvial plain and the flood plain are mixtures of sand and silt with varying proportions (see Figure 1.5). The alluvial flood plain consists of younger and older alluvial deposits (CGWB, 2013-14). Dhakuakhana town falls in the older flood plains zone.

Figure 1.5: Geomorphological Characteristics of Dhakuakhana Town in Lakhimpur District, Assam



Source: <https://bhuvan-app1.nrsc.gov.in/thematic/thematic/index.php> (2005).

1.13 Surface Water Resources

Dhakuakhana subdivision is bounded on the east by the Brahmaputra River and to the west by the Subansiri River the tributaries further drain the various areas of the subdivision. Charikariya and Karha rivers, two sub-tributaries of the Brahmaputra River are major surface water resources for the Dhakuakhana town. The Charikariya is a perennial sub-tributary of the Brahmaputra River which flows through the

Dhakuakhana town from Jiamaria Huz Goan to Katharbari for a length of about 7 km. The river is meanders, and it has many erosion-affected areas within the Dhakuakhana town itself. Karha River flows across the Dhemaji civil sub-division for a length of about 19 km to fall out in the Subansiri River at Selamukh. The river flows from the Dhakuakhana town on the west.

1.14 . Groundwater Resources

Younger and older alluvial formations are found between Shivalik and Younger alluvial foothills. The alluvial formations in the foothills are composed of sand, pebble, cobble, and boulders. These materials have high permeability. In the flood plain area, however, little gravel mingles with different grades of sand. Dhakuakhana town is in the older alluvial deposit region of the district. It is feasible to dig shallow tube wells within 30-40 m depth with a yield capacity of 35-40 m³ per hour in Dhakuakhana. The highest water table is 110 m above mean sea level in the flood plain area towards the south. In general, the gradient of flow is high towards the west as compared to the gradient in the eastern part. In the northern foothill region, the water table gradient is steeper (1.5m per km) and it forms the recharge zone for the entire district.

Almost the entire district is occupied by unconsolidated alluvial sediments except for the hilly areas in the northern parts. About 65 sq km of the hilly area has a slope greater than 20 percent in the district and this area is excluded from resource calculation as this area is not likely to contribute to groundwater recharge. There is no command area in the district. So entire district has been considered as a non-command area and calculation was done for the non-command area only. The bottom of the unconfined aquifer is found within 10 to 20 mbgl. Total annual groundwater recharge of the district is estimated as 1,33,128 ham. An allowance of 5 percent of the total was kept for natural discharge and the Net Ground-Water Availability in the district has been worked out as 1,19,815 ham (**see Table 1.3**).

Table 1.3: Ground Water Resource Potential in Lakhimpur District, 2009

Total Geographical Area (Hectare)	Recharge from Rainfall (ham)			Recharge from other sources (ham)			Total Annual Ground Water Recharge (ham)	Natural Discharge (ham)	Net Ground Water Availa- bility (ham)
	Mon- soon	Non- Mon- soon	Total	Mon- soon	Non- Mon- soon	Total			
2,27,700	80,114	48,773	1,28,887	3,385	856	4,214	1,33,128	13,313	1,19,815

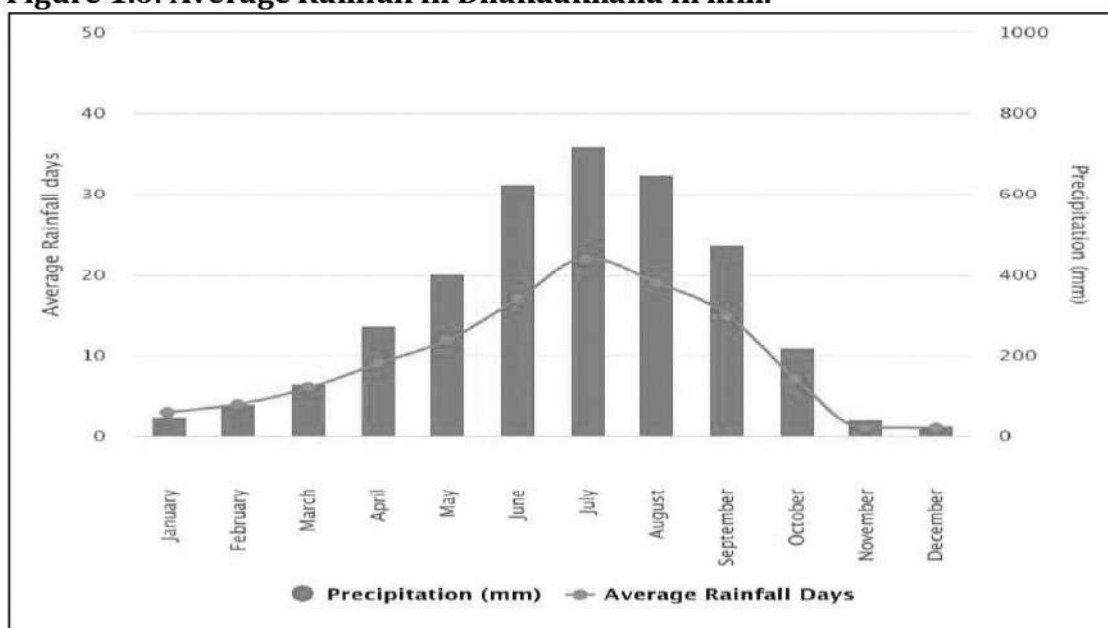
Source: CGWB Report for Lakhimpur District (2013).

1.14.1 Groundwater Quality

Water samples were collected from Ground Water Monitoring Stations (GWMS) of the district for assessing the chemical quality of groundwater and determining its suitability for drinking and irrigation purposes. From the chemical analysis data of groundwater samples, it is found that the groundwater of the dug wells in the district is slightly acidic to slightly alkaline (pH= 5.83 to 7.11). Electrical conductance (EC) of groundwater varies from 89 to 473 detectable limits. However, fluoride content was found to be within the permissible limit. Iron content generally varies from 0.13 to 6.98 mg/l. It is observed that iron content is generally high in permanently waterlogged areas.

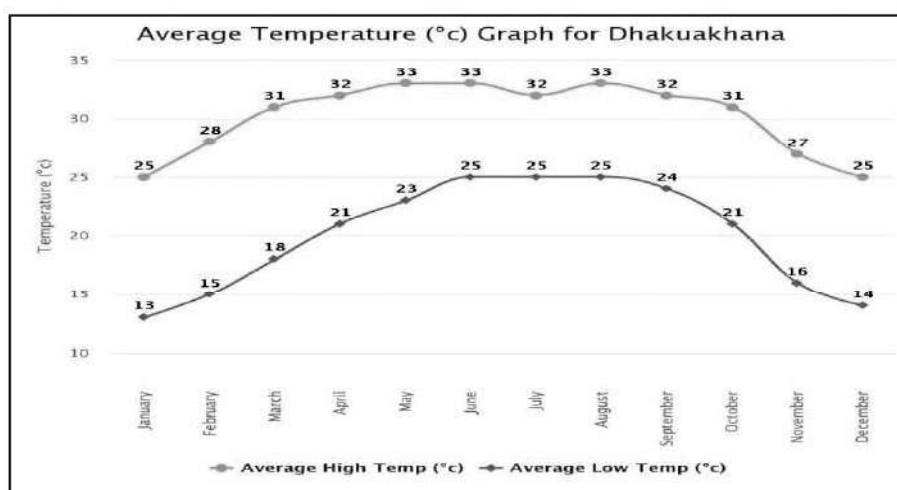
1.15 Climate

The prevalence of cold and pleasant spring is found in the town. High humid temperatures and exorbitant rains during monsoon and summer are experienced in the area. Temperature is high during the South-West monsoon season which generally starts in June and lasts till the beginning of October every year. Maximum rainfall occurs during July month with an average precipitation of 719.4 mm, and the average number of rainy days is 10 (see Figure 1.6).

Figure 1.6: Average Rainfall in Dhakuakhana in mm.

Source: <https://www.worldweatheronline.com/dhakuakhana-weather/assam/in.aspx> (April 2022).

The winter season starts from the beginning of November till late February. Winters are generally cold and foggy. Weather from February-March is usually windy with scattered rain showers. From April to May, weather is a period of thunderstorms and heavy rainfall. It is important to note that rain occurs almost throughout the year. Over the year, the temperature typically varies from 13°C to 33°C and is rarely below 10°C or above 34°C. The hot season lasts for 5 to 6 months, from May to October with a temperature range of 23°C to 33°C. Average minimum and maximum temperature during winter is 13°C to 25°C (see Figure 1.7).

Figure 1.7: Average Temperature of Dhakuakhana Town in Degree Celsius 2021

Source: <https://www.worldweatheronline.com/dhakuakhana-weather/assam/in.aspx> (April 2022).

1.16 Conclusions

The municipal area has a population of 13,502 as per Census India, 2011 and the planning area has a population of 31,577. Based on this it could be classified as a class IV town. Dhakuakhana has one urban local body in the town which is Dhakuakhana Municipal Board. It is divided into 10 electoral wards. Charikariya and Karha rivers flow across the southern and western sides of the town. Dhakuakhana is well connected by roadways to nearby towns and cities. At present, the railways and waterways connectivity of the town is not good. However, nearly 90 percent of the roads in the town are *pucca* roads. Dhakuakhana town falls in the older alluvial zone which makes its groundwater level be 2-5 mbgl. Groundwater quality in the town is within the permissible limits. The presence of cold and pleasant spring and high humid temperature with heavy rains during summer and monsoon are the characteristic features of the climate of Dhakuakhana.

ANALYSIS OF SECTORS

CHAPTER 2: DEMOGRAPHY

2.1 Introduction

Demography is the study of the total population, focusing on trends over time, comparisons of subgroups, and causes and consequences of key population parameters. Demography of a settlement usually decomposes into several key population parameters such as age, gender, race or ethnicity, marital status, or economic status (Axinn, 2016). Demography not only deals with the size and composition of the population but also deals with the dynamic life course processes that change this composition like birth, death, unions, migration, etc. and the relationships between population composition and change, the broader social and physical environment in which they exist (Lundquist, 2015). Demography sheds light on important social, economic, political, and environmental issues and their impacts, such as population growth, urbanization, family change, immigration, human health, longevity which are important tools to create the base of any planning process.

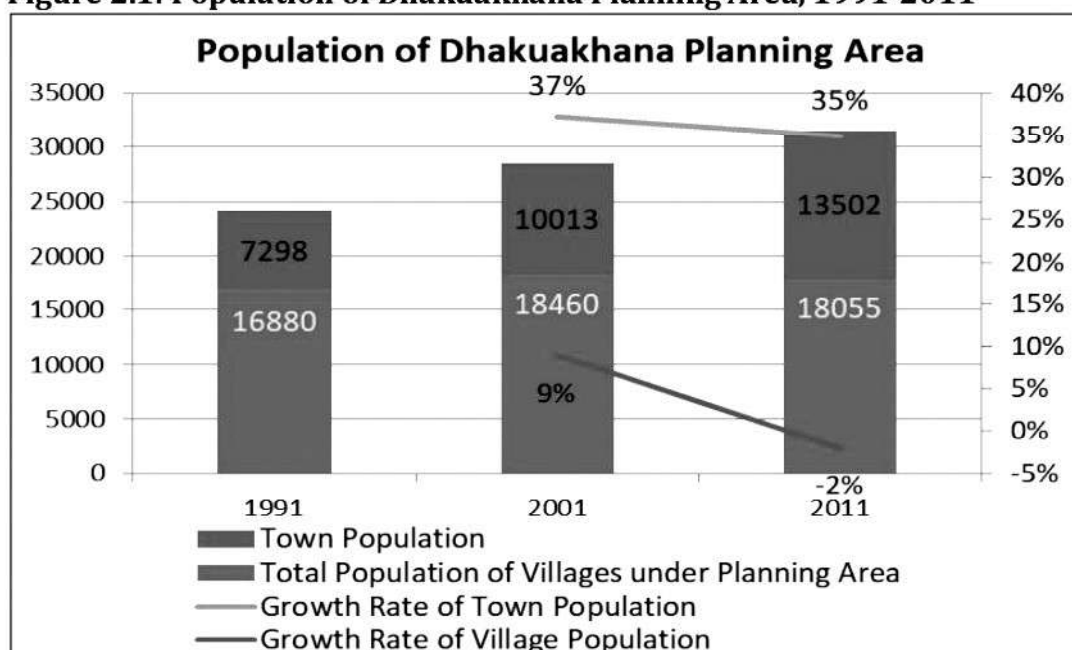
To study the demography of Dhakuakhana Town, two approaches have been used, first is static demographic analysis which deals with the current situations of the population, their structure or composition, and second is dynamic analysis of population which deals with the trend of the population and furthers the analytical correlation between demography with the socio-economic aspect. The chapter deals with demographic and social aspects which include the population growth rate, population distribution, religious and caste composition, sex ratio, literacy rate, etc.

2.2 Population of Dhakuakhana Planning Area

Dhakuakhana was officially notified as a town in the year 2008. Before that, the area was categorised as rural and comprised of the villages' viz. Huz Goan, Konwar Ghahi, Charuk Barpatta, Bangala Chapari and Mahghuli Chapori. Hence, though the area has been described as 'urban' in Census 2011, it would fall in the 'rural' category in Census 2001 and Census 1991. Also, the town was initially divided into four wards, but later, in the year 2021, these wards were subdivided further into 10 wards. Currently, the planning area of Dhakuakhana town comprises of Dhakuakhana town and 24 other villages listed in the **Table 2.1** of which Kuhimari Chapari village is uninhabited. According to census of India 2011, the total population of Dhakuakhana planning area is

31,557 of which town population is 13,502 comprising 42.8 percent and total population of villages is 18,055 comprising 57.2 percent of population of planning area respectively. During census year 2001-11, the total population of planning area was 28,473 of which 10,013 people resided within Municipal Boundary and 18,460 people resided in villages (see Figure 2.1).

Figure 2.1: Population of Dhakuakhana Planning Area, 1991-2011



Source: Census of India (1991, 2001, 2011).

2.3 Demographic Profile of Dhakuakhana Planning Area

Table 2.1 depicts census year wise population of villages their population density, sex ratio, Schedule Caste population and its contribution to the main population, Schedule Tribe population and contribution to total population and literacy rate.

2.3.1 Population Growth Rate

According of Census of India 2011, population growth is different for urban and rural context in Dhakuakhana planning area. Population growth for Dhakuakhana town between census year 1991 and 2001 was 37 percent and for year 2001 to 2011 it was 35 percent. However, for villages of planning area, the population growth was nine percent during census year 1991 to 2001 which decreased to -2 percent for year 2001

to 2011 resulting in decrease of rural population in planning area (see Figure 2.1). This indicates that population from rural areas are attracted towards Dhakuakhana town.

Table 2.1: Demographic Profile of Dhakuakhana Planning Area, 1991-2011

S. No.	Name of Village	1991	2001	2011	Population Density	Sex Ratio	SC Population	Percentage Contribution	ST Population	Percentage Contribution	Literacy Rate
1	Bahpara	938	955	958	2.0	988	18	2	56	6	79.4
2	Bantow Chamuah Pathar	204	830	315	2.8	864	66	21	0	0	
3	Bantow Gaon	1,022	1630	2740	8.1	954	825	30	12	0	
4	Bantow Pathar	572	176	149	0.8	910	11	7	2	1	
5	Bhalukguri Chapari	261	546	235	3.2	1,009	59	25	0	0	
6	Borhola Chapari	27	25	9	0.1	500	1	11	0	0	
7	Daghala Chapari	607	517	247	1.4	945	0	0	0	0	
8	Dakhin Chapari	136	159	124	0.6	1,067	91	73	0	0	
9	Dighala Hiloi Dhari	2,060	2,319	2,539	8.8	988	206	8	9	0	
10	Dullapara Bhari	1,872	1,960	880	10.5	1,090	0	0	1	0	
11	Gohain Bari	892	945	802	5.5	1,020	0	0	5	1	
12	Gohain Bari Pathar	25	287	135	1.0	901	0	0	0	0	
13	Gohain Handique	1,564	1,490	1,584	5.7	990	0	0	0	0	
14	Jarani Chapari	24	65	87	0.4	933	83	95	0	0	
15	Jiamoria Gaon	2,146	2,278	2,351	10.9	991	468	20	5	0	
16	Kalakata Chetia	1,657	1,585	2,032	11.1	963	862	42	8	0	
17	Kuhimari Chapari	328	16	0	0.0	0	0	0	0	0	
18	N.C. Bantow	379	77	49	0.1	960	0	0	0	0	
19	N.C. Simaluguri	465	531	637	1.1	919	287	45	2	0	

S. No.	Name of Village	1991	2001	2011	Population Density	Sex Ratio	SC Population	Percentage Contribution	ST Population	Percentage Contribution	Literacy Rate
20	Narayanpur Chapari	345	191	203	4.3	1,010	0	0	0	0	
21	No.1 Ghilaguri	465	23	425	1.1	995	0	0	2	0	
22	No.2 Ghilaguri	71	531	66	0.5	886	0	0	3	5	
23	Pithiyal	750	1238	1371	6.4	984	1,199	87	4	0	
24	Teliachapari	70	86	117	0.6	1,053	0	0	0	0	
Total Village Population		16,880	18,460	18,055			4,163	23	109	1	
Town Population		7298	10013	13502	10.7	946	2,663	20	829	6	89.1
Total Population of Planning Area		24,178	28,473	31,557							

Note: The area was classified as 'rural' till Census 2001 and has been categorised as 'urban' in Census 2011 after the formation of Dhakuakhana town in 2008.

Source: Census of India (2011).

2.3.2 Village wise Population of Planning Area

According to census of India 2011, Bantow Gaon village has the highest population with 2,740 persons followed by Dighala Hiloi Dhari village with population of 2,351. Jiamoria Goan and Kalakata Chetia are other villages with population of 2,351 and 2,032 respectively having population more than 2000 persons. There is only one village which has population of range 1500-2000 which is Gohain Handique with population of 1,584 and one village in the range of 1000-1500 which is Pithiyal with population of 1,371. There are four villages which has population of range 500-1000. Apart from these villages, 13 villages have population below 500 with four of the villages having population in double digits and one village is uninhabited. This implies that population is scattered within the planning area and no major village (village with population more than 5000) is under Dhakuakhana Planning area (see Table 2.1).

2.3.3 Sex ratio

Sex ratio is used to describe the number of females per thousand males in an area. In Dhakuakhana town, as per Census 2011, the male population has increased from 3,875 in 1991 to 6,940 in 2011 while the female population has increased from 3,423 in 1991 to 6,562 in 2011 as shown in Table 2.2. Growth rate for male population has decreased from 36.4 percent for 1991-2011 to 31.3 percent for 2001-11. This can be attributed to the out-migration of youth due to lack of employment opportunities in the area. For female population, the growth rate is almost static, that is, around 38 percent for both these decades. Overall, the sex ratio for the area has improved from 883 in 1991 to 945 in 2011. This is however, lower than the sex ratio of Lakhimpur district, which is 968.

Table 2.2: Sex Ratio in Dhakuakhana Town Area from 1991 to 2011

Year	Male population		Female population		Sex ratio
	Number	Growth Rate (Percent)	Number	Growth Rate (Percent)	
1991	3,875	-	3,423	-	883
2001	5,287	36.44	4,726	38.07	894
2011	6,940	31.26	6,562	38.85	945

Source: Census of India (2011).

Village wise sex ratio is mentioned in **Table 2.1** which indicates that six villages have sex ratio more than 1000 with the highest ratio of 1090 female for every 1000 male in Dullapara Bhari village followed by Dakhin Chapari village which has sex ratio of 1067. Other than these villages, nine villages have sex ratio higher than Dhakuakhana town however, their ratio is lesser than 1000. 12 villages have sex ratio less than town average with Borhola Chapari having least sex ratio of 500 however, the total population of the village is only 27. It has to be noted that, villages having lesser sex ratio does not have population more than 600 with the N.C. Simaluguri village being the most concerning village having a total population of 637 and a sex ratio of 919.

2.3.4 Literacy Rate

According to the Census of India, a person aged seven and above, who can both read and write with understanding in any language, is treated as literate. Accordingly, the literacy rate is worked out by excluding the sub-population in the age group of 0 to 6 years from the total population. **Table 2.3** shows that the male literacy rate in Dhakuakhana

increased from 83 percent in 1991 to 93 percent in 2011. Female literacy rate, on the other hand, increased from 68.8 percent in 1991 to 85 percent, demonstrating a significant improvement in the education status of female population. Overall, the literacy rate has risen from 76.4 percent in 1991 to 89.1 percent in 2011, which is higher than the literacy rate of Lakhimpur district, that is, 86.9 percent. The average literacy rate of villages in Dhakuakhana Planning Area is 79.4 percent.

Table 2.3: Literacy Rate for Dhakuakhana Town Area from 1991 to 2011

Year	Male Literacy Rate (percent)	Female Literacy Rate (percent)	Total Literacy Rate (percent)
1991	83.09	68.88	76.44
2001	88.65	76.78	83.09
2011	92.95	85.06	89.11

Source: Census of India (2011).

2.3.5 Scheduled caste and scheduled tribe

The Scheduled Castes (SCs) and Scheduled Tribes (STs) have been officially identified among the most disadvantaged socio-economic groups in the Constitution of India. As per Census of India, the SC population in Dhakuakhana town has increased from 1,750 in 1991 to 2,663 in 2011 and the ST population has risen in number from 64 in 1991 to 829 in 2011, as given in **Table 2.4**. The scheduled tribe population of the town is much lesser as compared to the population in the scheduled caste category. However, when expressed as a share of the total population, the percentage of SC population has gone down from 24 percent in 1991 to 19.7 percent in 2011 while the percentage of ST population has gone up substantially from 0.8 percent in 1991 to 6.1 percent in 2011. Hence, over the years, the share of Dhakuakhana tribal population has increased.

Table 2.4: SC-ST Population in Dhakuakhana Town Area from 1991 to 2011

Year	SC population		ST population	
	Number	Percent (of total population)	Number	Percent (of total population)
1991	1,750	23.98	64	0.88
2001	2,127	21.24	331	3.31
2011	2,663	19.72	829	6.14

Source: Census of India (2011).

According to census of India 2011, the total SC population in villages of Dhakuakhana planning area is 4,163 which contribute 23 percent to the total population of villages within planning area. Jarani Chapari and Pithiyal have the highest contribution of SC population with 95 and 87 percent respectively to their total population. Details of other villages can be observed in **Table 2.1**. Total ST Population in villages are 109 which is only one percent of total rural population which signifies that ST population is lesser in rural areas when compared to urban area of Dhakuakhana planning area.

2.3.6 Population Density

Population density is a measure of the population per unit area. Table 2.5 examines urban population density in Dhakuakhana town. The population density has increased from 5.29 persons per hectare in 1991 to 7.27 persons per hectare in 2001. For the year 2011, the population density in Dhakuakhana town is 10.7 persons per hectare which is higher than the population density of Lakhimpur district, that is, 4.57 persons per hectare.

Table 2.5: Population Density of Dhakuakhana Town Area from 1991 to 2011

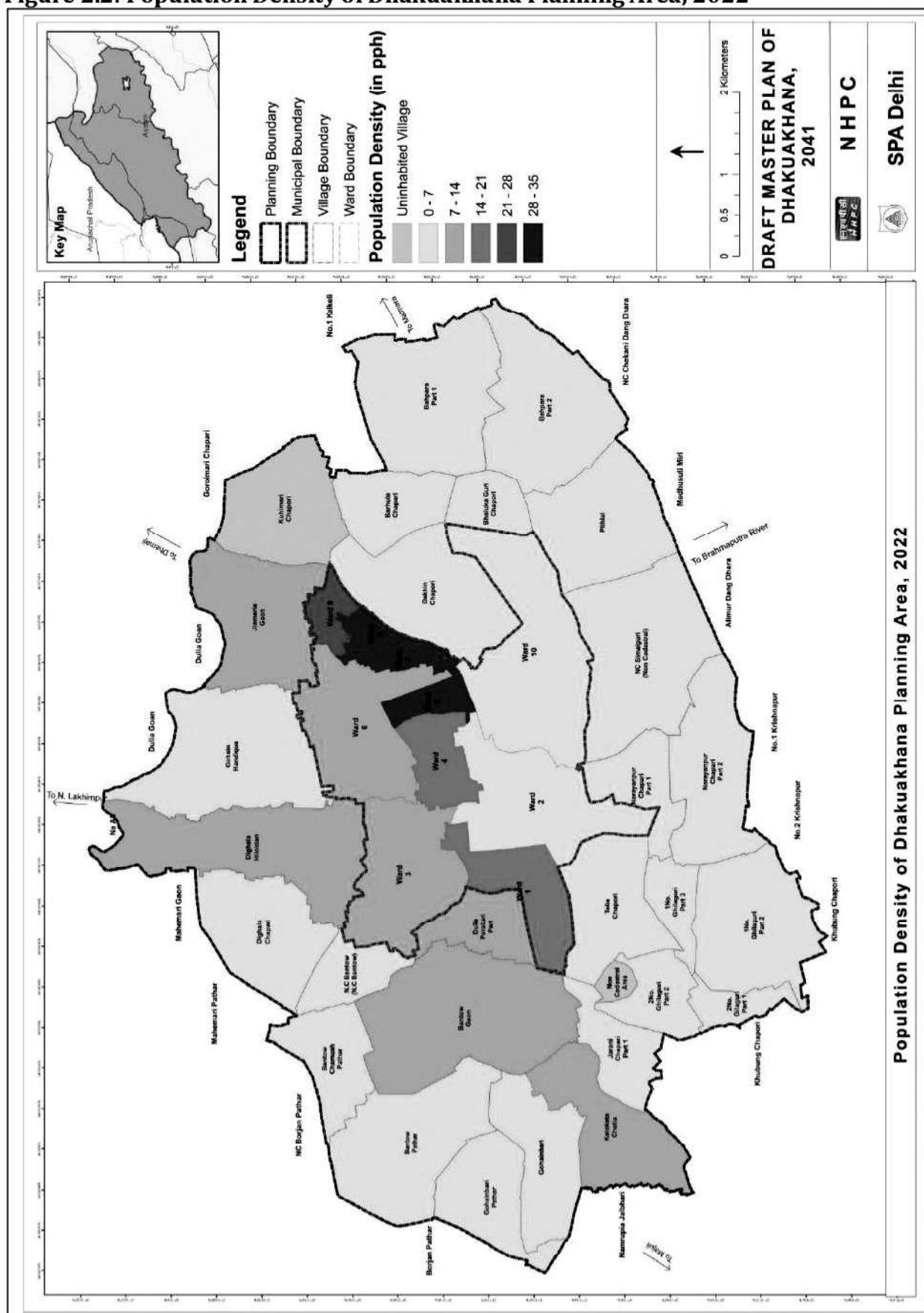
Year	Population Density (Persons per hectare)
1991	5.29
2001	7.27
2011	10.70

Note: The area was classified as 'rural' till Census 2001 and has been categorised as 'urban' in Census 2011 after the formation of Dhakuakhana town in 2008.

Source: Census of India (2011).

According to census of India 2011, there are three villages with population density more than 10 in Dhakuakhana Planning area viz. Kalakata Chetia, Jiamoria Goan and Dullapara Bhari having population density of 11.1, 10.9 and 10.5 persons per hectare (PPH) respectively. Five villages have population density between the ranges of 5 to 10 PPH (**see Table 2.1 and Error! Reference source not found.**). This signifies that the opulation in planning area is very scattered and majority of land being open fields.

Source: Primary Survey, SPA New Delhi (2022).



2.4 Workforce Participation in Dhakuakhana Planning Area

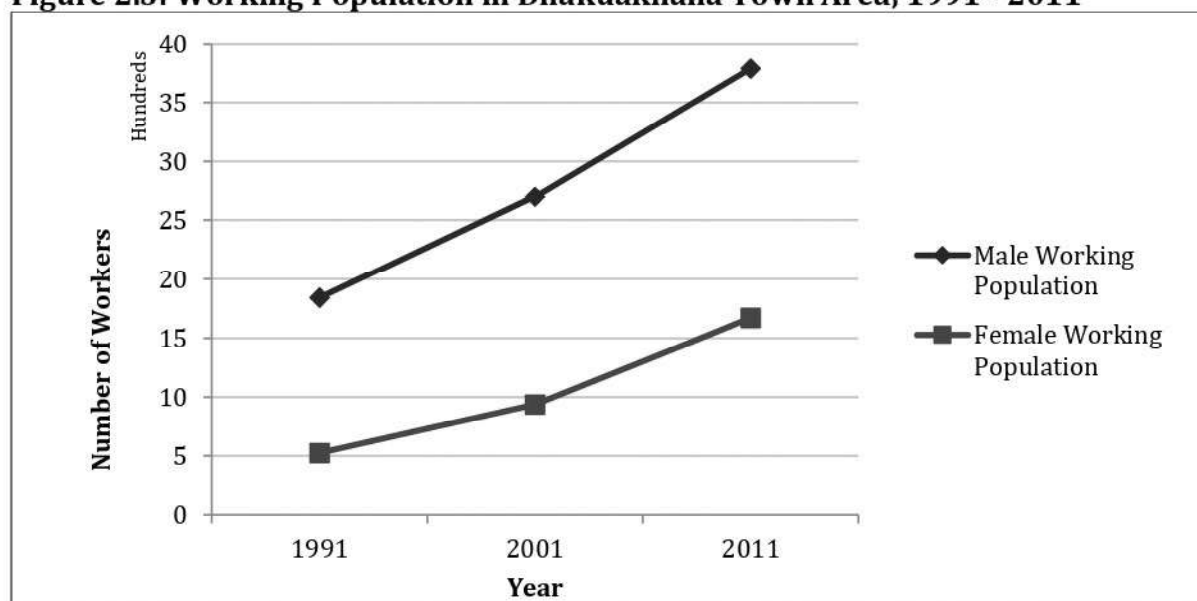
According to the Census of India, a worker is defined as any person engaged in an economically productive activity with or without compensation, wages or profit. The workforce participation rate is the population that is either working or actively looking for work. The reference period for determining a person as a worker is one year preceding the date of census enumeration. Table 2.6 provides an analysis related to workforce participation for Dhakuakhana town area from 1991 to 2011.

Table 2.6: Working Population in Dhakuakhana Town from 1991 to 2011

Year	Male Working Population (percent)	Female Working Population (percent)	Total Working Population (percent)
1991	47.59	15.39	32.48
2001	51.09	19.89	36.36
2011	54.59	25.48	40.44

Source: Census of India (2011).

From 1991 to 2001, the percentage of female working population to the total female population in the area has increased from 15 percent to 20 percent and in 2011, it has grown further to over 25 percent. The male working population (as a percentage of the total male population), however, continues to be higher, increasing from 47 percent in 1991 to 55 percent in 2011. Overall, the percentage of total working population in Dhakuakhana town area has increased from 32.4 percent in 1991 to 40.4 percent in 2011. Though the female working population has increased over the years, the humungous difference in the share of male and female workers is indicative of most women being engaged in household work. **Figure 2.3** shows that in the Dhakuakhana town area, the male working population has almost doubled and the female working population has more than tripled from 1991 to 2011.

Figure 2.3: Working Population in Dhakuakhana Town Area, 1991 - 2011

Source: Census of India (2011).

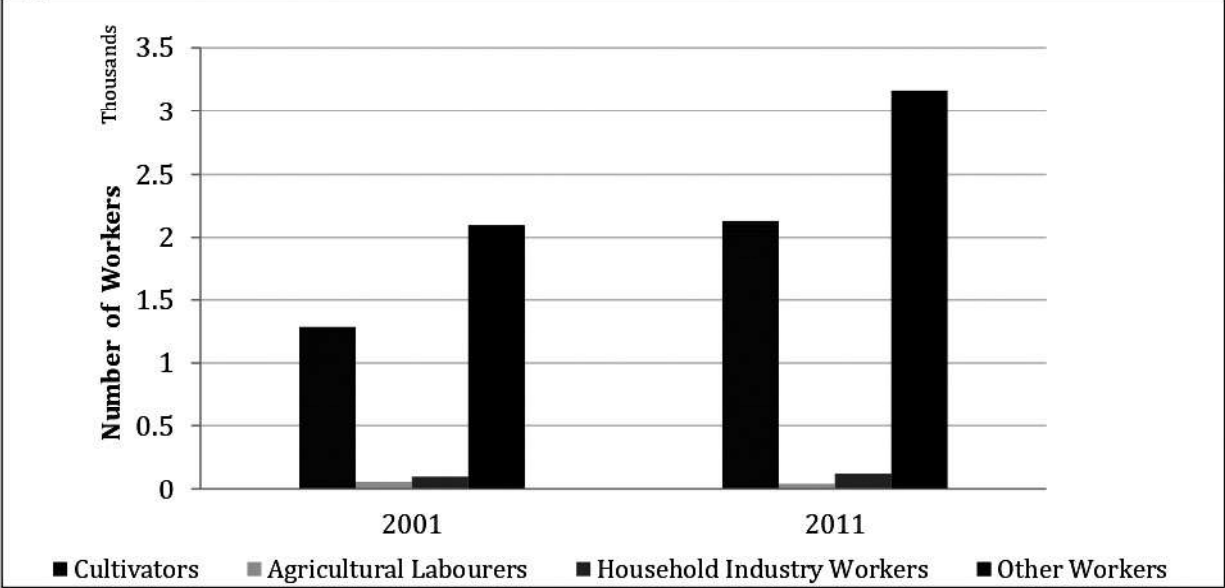
According to the Census of India, based on the type of work, workers are further classified as cultivators, agricultural labourers, household industry workers and other workers. Cultivators are engaged in the cultivation of land either owned or held from government or private persons or institutions. An agricultural labourer, on the other hand, works on another person's land for wages. Similarly, household industry workers are those engaged in an industry conducted by one or more members of the household, mostly within the precincts of the house where the household lives. All other workers who cannot be classified as cultivators, agricultural labourers, or household industry workers, fall in the category of 'other workers'. The category-wise bifurcation of the working population in Dhakuakhana town area is shown in **Table 2.7** and **Figure 2.4**. It is noteworthy that maximum number of workers are 'other workers', followed by cultivators. Though the percentage of cultivators has increased from 2001 to 2011, the percentage of agricultural labourers has declined.

Table 2.7: Workers in Dhakuakhana Town area in 2001 and 2011

Type of Workers	Population (percent)	
	2001	2011
Cultivators	36.31	38.98
Agricultural Labourers	1.67	0.75
Household Industry Workers	2.87	2.29
Other Workers	59.14	57.88

Source: Census of India (2011).

Figure 2.4: Workers in Dhakuakhana Town in 2011 and 2011



Source: Census of India (2011).

2.5 Conclusions

Dhakuakhana decadal population growth rate has slightly decreased from 37.2 percent in 2001 to 34.8 percent in 2011, which is a result of the out-migration driven by the dearth of employment opportunities in this area. Unemployment is a major issue here which can be solved by further promoting and developing industrial and commercial establishments.

The town's sex ratio has increased from 883 in 1991 to 945 in 2011, which is indicative of an increase in female births. Additionally, the literacy rate increased from 76.4 percent in 1991 to 89.1 percent in 2011. In fact, the increase in the female literacy rate has been greater than that for males. The rate of workforce participation increased from 32.4 percent to 40.4 percent between 1991 and 2011, which is also a positive trend. According to the Census of India 2011, more than 55 percent of the workers are 'other workers' indicating that most of the local workforce is employed in secondary and tertiary economic activities. From 2001 to 2011, the percentage of cultivators has grown, reflecting a discernible trend towards an agrarian economy.

The primary survey findings revealed that the town area continues to retain its rural character and there is immense scope for development in terms of infrastructure, utilities, and services.

CHAPTER 3: ECONOMY

3.1 Introduction

The economy is the backbone of any town. A thriving economy will aid in the development of the town's infrastructure. The goal of a master plan is to encourage economic growth through policy and spatial planning initiatives. It entails the provision of infrastructure amenities in terms of land allocation and development in accordance with standards, as well as policy incentives to promote and protect the economy. Thus, establishing enough job opportunities and raising the standard of life for its population is critical.

The current situation of Dhakuakhana worker, according to the Census of India, has been covered in this chapter. The current economic scenario of Dhakuakhana, namely trade and commerce; health and education services, informal economy, industries, agriculture, sericulture, and associated activities, has been thoroughly explored. This section describes the role, contribution, strength, problems, and prospects of economic sectors. Finally, remarks are provided on the overall economic condition in the Planning Area.

3.2 Workers Characteristics

As per the census 2011, out of the total population of 31,557 the working population comprises 12,614 persons in the town which makes up around 40 percent of the total population. Around 60 percent of the people in the town are non-workers. The economy of Dhakuakhana town relies majorly on agricultural and allied activities.

Out of the total population, 27 percent males and only 13 percent of females are a part of the working population. Further out of the total working population, 59 percent of the males and only 14 percent of females are a part of the main workers. Nearly 9 percent of the male population is employed, and 17 percent of the female population is employed as marginal workers (**see Table 3.1 and Table 3.2**). Amongst the total worker population 24 percent males and 36 percent females are part of the dependent population.

Table 3.1: Worker's Profile of Dhakuakhana Town, 2011

Total Population			Number	31,557
Worker Population	Worker Population	Male	Number	8,612
			Percent	27.00
		Female	Number	4,002
			Percent	13.00
	Main Worker	Male	Number	7,482
			Percent	59.00
		Female	Number	1,812
			Percent	14.00
	Marginal Worker	Male	Number	1,130
			Percent	9.00
		Female	Number	2,190
			Percent	17.00
Non-worker Population		Male	Number	7,446
			Percent	24.00
		Female	Number	11,497
			Percent	36.00

Source: Census of India (2011).

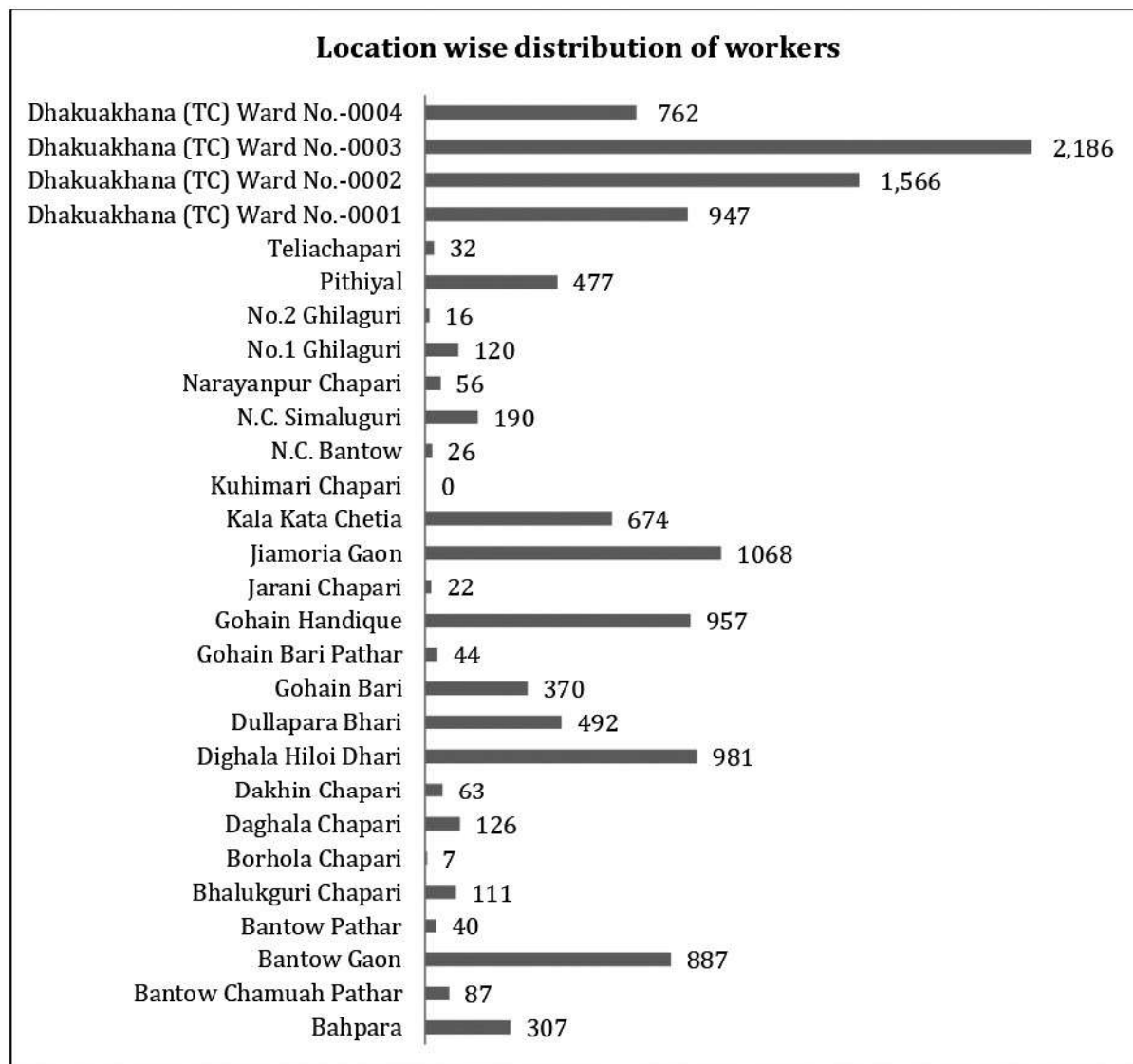
Table 3.2: Worker and Non-worker in Dhakuakhana Town, 2011

Sl. No	Name of Village	Census code	Census Name of Village	Worker Population			Non-workers		
				Total	Male	Female	Total	Male	Female
1	Bahpara Part 1	288395	Bahpara	307	267	40	651	215	436
2	Bahpara Part 2								
3	Bantow Chamuah Pathar	288350	Bantow Chamuah Pathar	87	79	8	228	90	138
4	Bantow Gaon	288349	Bantow Gaon	887	740	147	1853	662	1191
5	Bantow Pathar	288341	Bantow Pathar	40	38	2	109	40	69
6	Bhaluka Guri Chapori	288392	Bhalukguri Chapari	111	57	54	124	60	64
7	Barhula Chapari	288396	Borhola Chapari	7	4	3	2	2	0
8	Dighala Chapari	288354	Daghala Chapari	126	63	63	121	64	57
9	Dakhin Chapori	288393	Dakhin Chapari	63	31	32	61	29	32
10	Dighala Hiloidari	288369	Dighala Hiloi Dhari	981	658	323	1558	619	939
11	Dulia Perabari Part	288348	Dullapara Bhari	492	239	253	388	182	206
12	Gohain Bari	288339	Gohain Bari	370	195	175	432	202	230
13	Gohain Bari Pathar	288342	Gohain Bari Pathar	44	35	9	91	36	55

Sl. No	Name of Village	Census code	Census Name of Village	Worker Population			Non-workers		
				Total	Male	Female	Total	Male	Female
14	Gohain Handique	288372	Gohain Handique	957	499	458	627	297	330
15	Jarani Chapari Part 1	288358	Jarani Chapari	22	20	2	65	25	40
16	Jiamatia Gaon	288371	Jiamoria Gaon	1068	696	372	1283	485	798
17	Kala Kata Chetia	288338	Kala Kata Chetia	674	459	215	1358	576	782
18	Kuhimari Chapori	288401	Kuhimari Chapari	0	0	0	0	0	0
19	NC Bantow	288436	N.C. Bantow	26	13	13	23	12	11
20	NC Simalguri	288410	N.C. Simaluguri	190	182	8	447	150	297
21	Narayanpur Chapori Part 1	288365	Narayanpur Chapari	56	46	10	147	55	92
22	Narayanpur Chapori Part 2								
23	1No. Ghilaguri Part 2	288360	No.1 Ghilaguri	120	111	9	305	102	203
24	1No. Ghilaguri Part 3								
25	2No. Ghilaguri Part 1	288361	No.2 Ghilaguri	16	16	0	50	19	31
26	2No. Ghilaguri Part 2								
27	Pithiyal	288394	Pithiyal	477	346	131	894	345	549
28	Telia Chapori	288364	Teliachapari	32	29	3	85	28	57
Total				7,153	4,823	2,330	10,902	4,295	6,607
1	Dhakuakhana Town Council	801578	Dhakuakhana (TC) Ward No.-0001	947	449	498	702	371	331
2			Dhakuakhana (TC) Ward No.-0002	1,566	1,162	404	2,516	912	1,604
3			Dhakuakhana (TC) Ward No.-0003	2,186	1,530	656	3,068	1,214	1,854
4			Dhakuakhana (TC) Ward No.-0004	762	648	114	1,755	654	1,101
Total				5,461	3,789	1,672	8,041	3,151	4,890
Grand Total				12,614	8,612	4,002	18,943	7,446	11,497

Source: Census of India (2011).

Most of the working class comes from town council and specifically from ward number two and three. Since ward two and three are part of the core city which are the major work canters. Most of the tertiary sector offices and employment opportunities are within and adjacent to these wards (see Figure 3.1).

Figure 3.1: Village and Ward Wise Worker Distribution in Dhakuakhana, 2011

Source: Census of India (2011).

As per census of India a main worker is someone who has worked for most of the year, that is, for 183 days or more, or for 6 months or more. And a marginal worker is someone who may have worked occasionally throughout the past year but not for most of it. Nearly 80 percent of main worker are males and only 20 percent are females. Whereas around 65 percent of the marginal workers are females and remaining 35 percent are males (**see Table 3.3**).

Table 3.3: Main and Marginal Worker in Dhakuakhana Town, 2011

S.N o	Villages and Towns Name	Census code	Census Name of Villages and Towns	Main Worker			Marginal Worker		
				Total	Male	Female	Total	Male	Female
1	Bahpara Part 1	288395	Bahpara	286	262	24	21	5	16
2	Bahpara Part 2								
3	Bantow Chamuah Pathar	288350	Bantow Chamuah Pathar	84	77	7	3	2	1
4	Bantow Gaon	288349	Bantow Gaon	717	640	77	170	100	70
5	Bantow Pathar	288341	Bantow Pathar	27	27	0	13	11	2
6	Bhaluka Guri Chapori	288392	Bhalukguri Chapari	61	53	8	50	4	46
7	Barhula Chapari	288396	Borhola Chapari	7	4	3	0	0	0
8	Dighala Chapari	288354	Daghala Chapari	64	61	3	62	2	60
9	Dakhin Chapori	288393	Dakhin Chapari	63	31	32	0	0	0
10	Dighala Hiloidari	288369	Dighala Hiloi Dhari	765	475	290	216	183	33
11	Dulia Perabari Part	288348	Dullapara Bhari	162	126	36	330	113	217
12	Gohain Bari	288339	Gohain Bari	189	170	19	181	25	156
13	Gohain Bari Pathar	288342	Gohain Bari Pathar	28	24	4	16	11	5
14	Gohain Handique	288372	Gohain Handique	545	347	198	412	152	260
15	Jarani Chapari Part 1	288358	Jarani Chapari	20	19	1	2	1	1
16	Jiamatia Gaon	288371	Jiamoria Gaon	876	634	242	192	62	130
17	Kala Kata	288338	Kala Kata	451	387	64	223	72	151
18	Kuhimari Chapori	288401	Kuhimari Chapari	0	0	0	0	0	0
19	NC Bantow	288436	N.C. Bantow	12	12	0	14	1	13
20	NC Simalguri	288410	N.C. Simaluguri	55	49	6	135	133	2
21	Narayanpur Chapori Part 1	288365	Narayanpur Chapari	47	42	5	9	4	5
22	Narayanpur Chapori Part 2								
23	1No. Ghilaguri Part 2	288360	No.1 Ghilaguri	106	100	6	4	11	3
24	1No. Ghilaguri Part 3								
25	2No. Ghilaguri Part 1	288361	No.2 Ghilaguri	16	16	0	0	0	0
26	2No. Ghilaguri Part 2								
27	Pithiyal	288394	Pithiyal	336	323	13	141	23	118
28	Telia Chapori	288364	Teliachapari	29	28	1	3	1	2
Total				4,946	3,907	1,039	2,207	916	1,291
1	Dhakuakhana Town Council	801578	Dhakuakhana (TC) Ward No.-0001	484	382	102	463	67	396
2			Dhakuakhana (TC) Ward No.-0002	1,441	1,121	320	125	41	84

S.No	Villages and Towns Name	Census code	Census Name of Villages and Towns	Main Worker			Marginal Worker		
				Total	Male	Female	Total	Male	Female
3			Dhakuakhana (TC) Ward No.-0003	1,685	1,441	244	501	89	412
4			Dhakuakhana (TC) Ward No.-0004	738	631	107	24	17	7
Total				4,348	3,575	773	1,113	214	899
Grand Total				9,294	7,482	1,812	3,320	1,130	2,190

Source: Census of India (2011).

Out of the total 3,320 marginal workers, 29 percent male marginal workers work for about 3 to 6 months, 58 percent female marginal workers work for around 3 to 6 month and remaining 5 percent males and 8 percent female marginal workers work for less than 3 months in a year (**see Table 3.4**). More focus and due consideration need to be given to the employment of females and their welfare in the tertiary sectors, trade, and commerce activities.

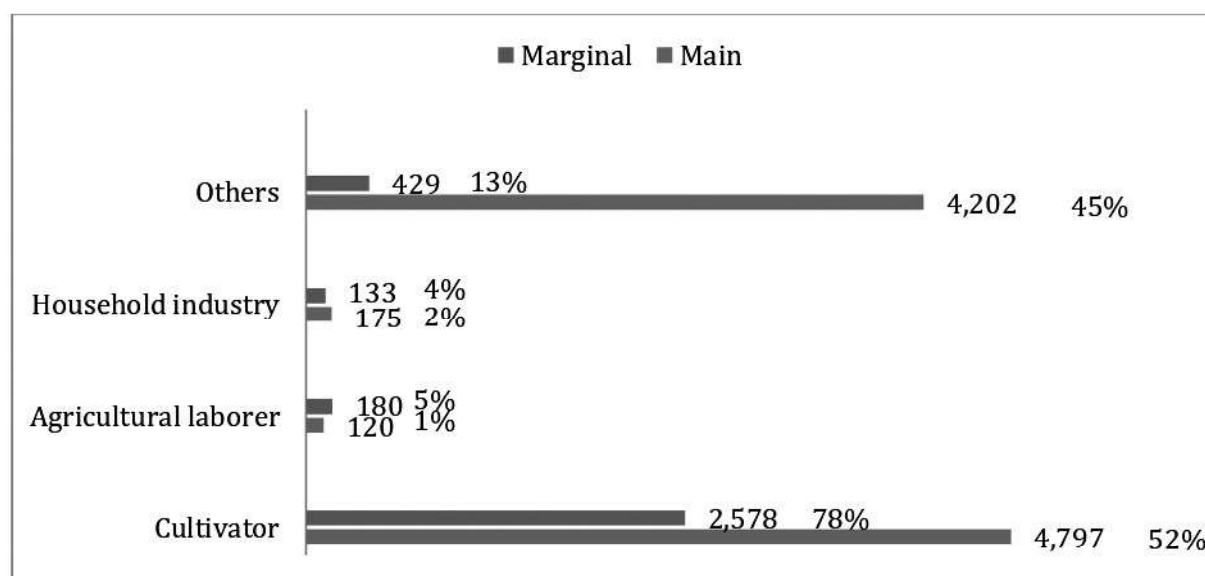
Table 3.4: Classification of Marginal Workers in Dhakuakhana, 2011

	3 to 6 months					0 to 3 months				
	Total	Male	Percent male worker of total marginal worker	Female	Percent female worker of total marginal worker	Total	Male	Percent male worker of total marginal worker	Female	Percent female worker of total marginal worker
Village	1,933	805	24	1,128	34	274	111	3	163	5
Town	961	171	5	790	24	152	43	1	109	3
Total	2,894	976	29	1,918	58	426	154	5	272	8

Source: Census of India (2011).

3.3 Sector Wise Distribution of Workers

Economy of Dhakuakhana is agriculture, sericulture and service sector driven. Most of the main workers are either cultivators or involved in other tertiary sector activities. Out of the total main workers around 52 percent are cultivators followed by 45 percent other workers indulged in tertiary sectors and remaining 3 percent either involved in household industries or are agricultural laborers. The marginal workers mostly work as cultivators, who work for less than 6 months in a year. Around 78 percent of the marginal workers are cultivators followed by other sectors 13 percent, agricultural laborer 5 percent and household industry workers 4 percent (**see Figure 3.2**).

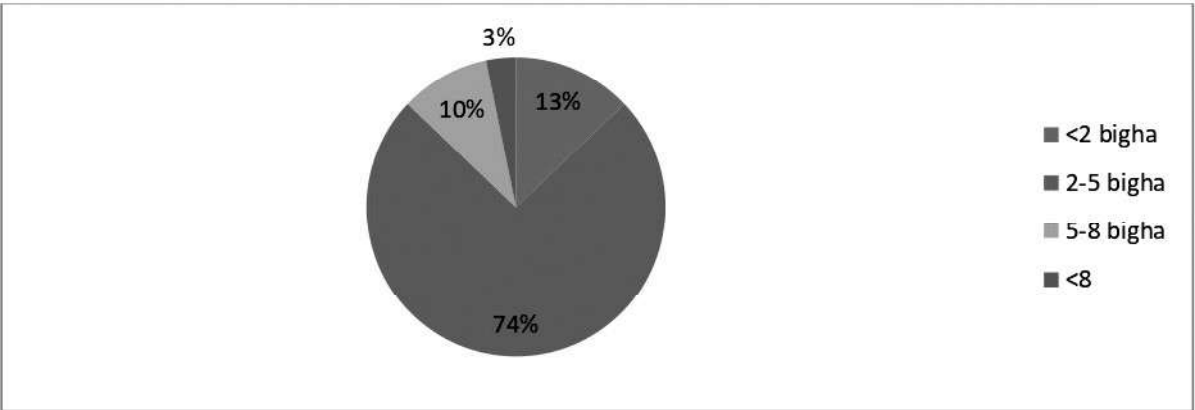
Figure 3.2: Sector Wise Distribution of Main and Marginal Workers, 2011

Source: Census of India (2011).

3.4 Agriculture

People in Dhakuakhana rural areas are mostly engaged in agriculture and allied activities. However, the number of workers involved in agriculture and related activities has decreased during the last two decades. This is due to the recurring flash floods in the town. According to the findings of the primary survey, approximately 53 percent of families possess agricultural land, which they either utilize for agriculture, sericulture, or fish breeding. Around 74 percent of households own a land parcel of 2 to 5 bighas, followed by 13 percent with a land holding size of around 13 percent, 10 percent with a land holding size of around 10 percent, and 3 percent with a land holding size of more than 8 bighas (see Figure 3.3).

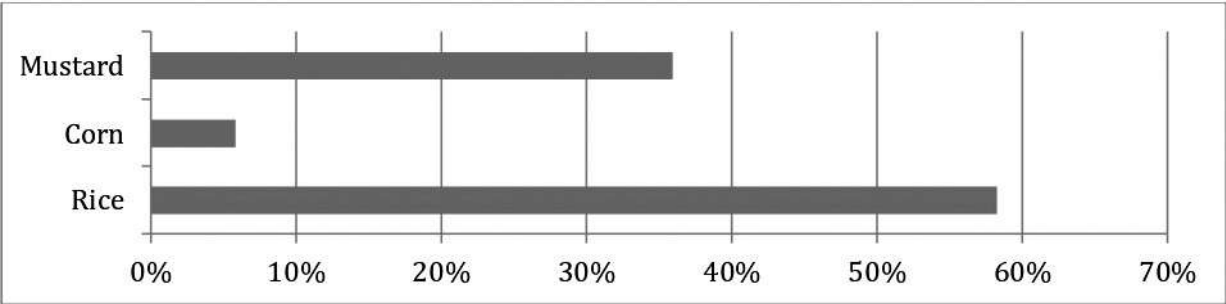
Figure 3.3: Agricultural Land Holding in Dhakuakhana, 2022



Source: Primary Survey, SPA New Delhi (2022).

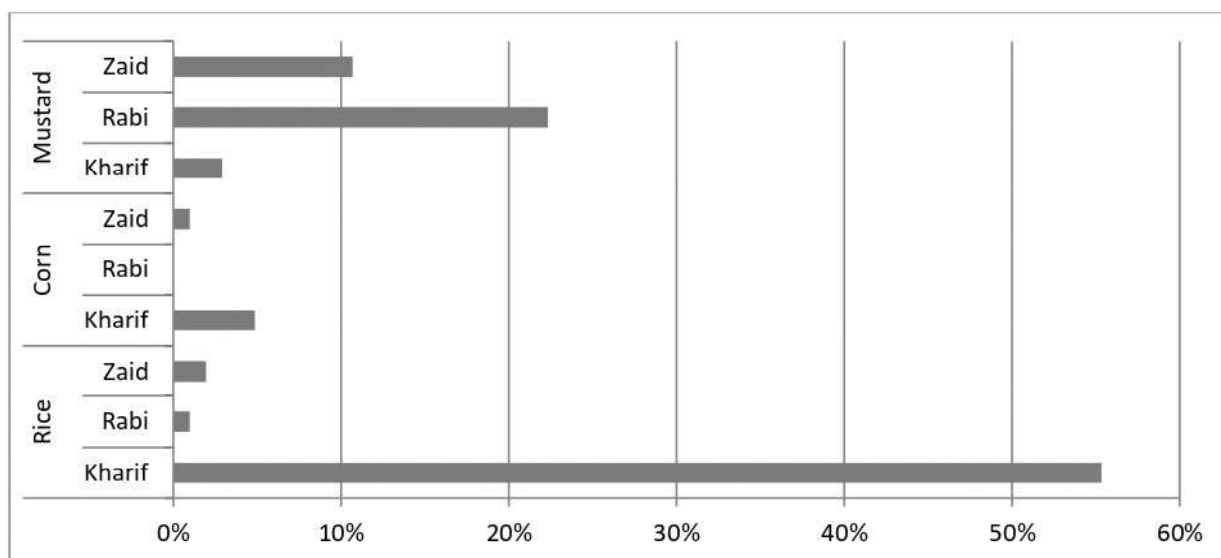
Further in 2011, only 47 percent of population was engaged in agriculture. Main reasons for this decline were the frequent flooding, lack of irrigation, and unavailability of open markets to sell the produce. Paddy is the major crop grown in the area followed by mustard and corn. Mostly, one crop is sown yearly. Only 5.18 percent area is irrigated, and rest of the area is dependent on rainfall for agriculture. Agriculture is mainly practiced for self-use and not for trading purposes (see Figure 3.4).

Figure 3.4: Major Crop Sown in Dhakuakhana, 2022



Source: SPA New Delhi (2022)

Kharif Crops are sown between July to October and harvested in the month of September to October. Paddy is mostly sown crop in this season. Rabi Crops are sown between October and November and harvested in the month of February to April. In Dhakuakhana mustard crop is usually sown in rabi season. Zaid Crops are sown between March and June and again mustard is the most grown crop in this season (see Figure 3.5 and Figure 3.6).

Figure 3.5: Crop Sown in Three Seasons of Dhakuakhana, 2022

Source: SPA New Delhi (2022)

Figure 3.6: Rice Cultivation Within Dhakuakhana Planning Area, 2022

Source: SPA New Delhi (2022).

3.5 Pisciculture

To address the serious employment concerns during and post covid 19, the Obonori Min Palon Samabai Samiti has launched an integrated fish rearing farm idea in which fish seeds would be grown alongside piggery and poultry farming. Unemployed teenagers would be able to find work through the scheme. Seeing the potential for money from fish farming, the citizens gradually began to pursue Pisciculture as an income producing

industry. The society's profit is used for different socioeconomic development goals in the area (see Table 3.5).

Table 3.5: Water Bodies Used for Pisciculture in Dhakuakhana Town, 2020

S. No.	Wards	Number of Water Bodies	Area in Hectare
1.	Ward No. 1	16	4.26
2.	Ward No. 2	18	9.53
3.	Ward No. 3	26	12.32
4.	Ward No. 4	08	4.08
5.	Ward No. 5	00	0.00
6.	Ward No. 6	18	10.21
7.	Ward No. 7	00	0.00
8.	Ward No. 8	12	6.32
9.	Ward No. 9	15	3.21
10.	Ward No. 10	21	15.28
Total		134	65.21

Source: Fisheries database of Dhakuakhana Municipality Board (2019-20).

Dhakuakhana is a home at producing 228 tons on fish in the financial 2019-20. There are 5 community ponds and 129 individual ponds which are being used for this proposed. The town imports approximately 250-300 tons of fish per year and exports approximately 150-200 tons per year. Around 134 to 140 households in the community are involved in the Pisciculture business.

Floods and erosion, limited pond water holding capacity, a lack of knowledge on better management practices, a lack of quality feed and seed, and a lack of proper marketing channels all have a significant impact on production. Another significant issue affecting productivity is chronic fish disease.

3.6 Sericulture

One of Assam's largest silk-producing districts is Lakhimpur. It has an ideal environment, replete with more than 380 kinds of host food plants for various sericigenous insets as Eri (*Philosamia richini*), Muga (*Antheraea assama*), Mulberry (*Bombyx mori*), etc., which have been traditionally raised in the district from time immemorial. As a result of its abundant natural vegetation of Assam and specially of Dhakuakhana, this area is home to a number of rare wild silk moth species, including *Attacus atlas* (Kotrori Muga), *Actias seleni* (Moon moth), *Antheraea pernyi* (Chinese Tasar moth), *Antheraea mylita* (Tassar), *Samia cynthia* (Ailanthus moth), and others,

contributing to its rich biodiversity. Dhakuakhana town is famous for “golden silk” (see Table 3.6).

Table 3.6: Workforce in Sericulture Plantation, 2022

S. No	Name of Plantation	Number of Seri Farmers
1.	Eri	3,670
2.	Muga	5,468
3.	Mulberry	1,298
Total		10,426

Source: Department of Sericulture, Dhakuakhana (2022)

3.6.1 Area under sericulture plantation

Below Table 3.7 and Table 3.8 comprehends the sericulture profile and land holding by government and private sector under sericulture plantation.

Table 3.7: Government Sector Farms for Plantation, 2022

S. No	Farm/ Centre	Total area (in Hectare)	Area under plantation (in Hectare)	Vacant Unit	Number of plants
1.	M.S.D.P Dhakuakhana	27.92	17.80	25	4,700
2.	Jalbhari	9.30	4.04	13	1,200
3.	Gobindapur	8.09	7.28	2	1,800
4.	Bhoma	14.16	2.02	30	300
5.	Bhoma CMG	6.07	2.02	10	500
6.	Sariyani ECC	9.30	7.28	5	1,700
Total		74.86	40.44	85	10,200

Source: Department of Sericulture, Dhakuakhana (2022)

Table 3.8: Private Sector Farms for Sericulture Plantation, 2022

S. No	Name of the plantation	Land area (in Hectare)
1.	Muga Plantation	404.28
2.	Eri Plantation	132.73

S. No	Name of the plantation	Land area (in Hectare)
3.	Mulberry Plantation	167.95
Total		704.96

Source: Department of Sericulture, Dhakuakhana (2022)

3.6.2 Capacity and production

Dhakuakhana town has a potential to produce 126 metric tons of raw silk, but only 22.5 percent of that capacity could be satisfied in the fiscal year 2020-2021 because to the COVID-19 pandemic, which not only hindered production but also the market in which the material was to be sold. **Table 3.9** comprehends the details of raw cocoon and raw silk produced in Dhakuakhana. **Figure 3.7** shows sericulture farmer growing Muga silk.

Table 3.9: Targets for Cocoon and Silk Production in Dhakuakhana, 2020-2021

S. No	Sector	Raw Cocoon		Raw Silk	
		Target	Achievement	Target (in kg)	Achievement (in kg)
1.	Muga	Rs. 8 Crores	Rs. 6 Crores	16,000	11,600
2.	Eri	1,31,250 kg	-	1,05,000	16,650
3.	Mulberry	50,000 kg	2,100 kg	5,000	210
Total				1,26,000	28,460

Source: Department of Sericulture, Dhakuakhana (2022).

Figure 3.7: Large Scale Muga Sericulture Farm in Dhakuakhana



Source: SPA, Delhi (2022).

3.6.3 Ongoing schemes

Assam Agribusiness and Rural Transformation Project (APART)

APART's primary goal is to strengthen chosen agriculture value chains and increase their resilience, with a particular emphasis on smallholder farmers and agro-entrepreneurs in selected districts of the State of Assam. As a part of this project two clusters namely Dhakuakhana, Ghilamara were identified to get benefits under this project (see Table 3.10).

Table 3.10: Targets and Achievements under APART Schemes, 2022

Year	Target for Plantation	Adopted Seed Rearers	Target for Grainure	Reeler	Achievement	Total project cost (in Rs.)
2018-19	60	-	0	0	56	20,600
2019-20	170	34	10	0	150 (ASR 100%)	39,200
2020-21	58	16	4	76	-	2,55,000

Source: Department of Sericulture, Dhakuakhana (2022)

Muga Mission

The mission's goal is to achieve worldwide leadership in Vanya silk, specifically Eri and Muga. Major purpose is to establish Muga silk as a significant brand. And to alter Assam's rural economy by encouraging the establishment of a dynamic silk industry using technology, incentive, and demonstration.

Under this mission 44-acre vacant government land, 528-acre private land is proposed for plantation of Muga and Eri silk. Further, 4,00,000 Som nursery are proposed to be raised for production. Furthermore, during the Covid 19 pandemic, an amount of Rs. 2,000 per person is granted to help 4,282 Muga rearers.

Rurban Mission

The Shyama Prasad Mukherji Rurban Mission (SPMRM) seeks to boost local economic growth, provide basic services, and establish well-planned Rurban clusters. The goal is to overcome the economic, technological, and facility and service gaps that exist between rural and urban communities. Moreover, it promotes local economic growth, with an emphasis on poverty and unemployment reduction in rural areas. the main emphasis is on Increased investment in rural areas.

Matmara, Pub Dhakuakhana and Kherkata were identified under this mission. A financial grant of Rs 15,500 provided for 0.5-acre plantation. Moreover, a grant of Rs. 65,000 for Eri rearing house and Rs. 40,000 for Muga jali house is also provided to support these Rurban clusters.

3.7 Conclusions

The Dhakuakhana planning area combines urban and rural elements. Workers in metropolitan regions are generally employed in the tertiary sector, whilst agriculture and related vocations are practiced in rural areas. Dhakuakhana town suffers from a lack of industrial growth. Unemployment results from the town's lack of industry. Industry and service sectors are critical to a town's long-term prosperity. When combined with the appropriate level of investment and skill development, these industries have the potential to provide the greatest number of job opportunities.

Due to a complete lack of food processing enterprises, agricultural output cannot be exploited to its full economic potential. The sericulture industry, which contributes significantly to the town's GDP, is also unable to generate sufficient economic prospects owing to a lack of effective skill development, awareness, and training among the population, as well as a market for the output. The town's unemployment crisis must be addressed as a top priority.

Rice, mustard, and silk are the primary products of Dhakuakhana town. Sericulture on government farms is typically absent of suitable fences and boundary walls. Manpower and supplies like as fertilizer, disinfectant, and seed are few. The private sector is short on educated employees and modern spinning gear, both of which they require at lower rates.

CHAPTER 4: HOUSING AND HABITAT

4.1 Introduction

Every resident in a community should have liveable housing with the necessary infrastructure and amenities, according to the master plan. The master plan should also be flexible enough to consider changes in housing diversity over time as communities grow. Therefore, housing encompasses more than just construction; it also concerns developing resilient communities with facilities that are necessary, like access to roads, drainage, water supply, and sanitation, social comforts, leisure, and livelihood. Residential land allocation, urban regeneration and re-densification projects, public housing, encouraging private participation through incentives, and so on are all examples of planning strategies that aim to provide affordable housing to all. The housing profile of a city includes the state of its houses, their structure, building materials, plot size, building levels, residential densities, etc. This chapter discussed the housing condition in Dhakuakhana Town focusing on the attributes such as the number of houses, household size, homelessness, type of houses, and their condition as per their usability in terms of qualitative measures, etc. as per Census of India 2011. The number, predominant use, condition, shortage, and congestion in housing have also been examined in the chapter. The beneficiaries and number of houses constructed and sanctioned under different housing schemes such as PMAY have also been carefully discussed.

4.2 Housing Typology

Unique dwelling typologies that are well suited to the local climate have developed in Dhakuakhana. The region uses building construction methods that are known to be resilient to disasters because it is prone to earthquakes and floods. Due to the ease of obtaining the raw materials, inhabitants in Dhakuakhana have traditionally lived in individual dwellings made of bamboo and wood. Despite the town's modest population and lack of space restrictions, RCC buildings and multi-story structures have grown significantly. This can be due to the rise in popularity of contemporary construction techniques, which people believe to be more convenient and durable. Many of these buildings are not earthquake resistant. Houses in the outskirts of the town are bigger than those in the core areas of the town. In the rural areas, most of the houses are

Assam type houses made of mud and bamboo. Many of these houses are built on raised stilts to provide protection from floods. The main types of houses found in Dhakuakhana include Ikra house, Mud house, Chang House, RCC houses and Composite Bamboo-RCC houses. As per Census 2011, in the urban area, the predominant material used for roofing is G.I., metal or asbestos sheet while in rural areas, bamboo, wood, thatch, etc. are also used. Walls are mostly made using bamboo, mud or burnt bricks. For flooring, cement and mud are the most common materials used.

4.2.1 Ikra House

The Ikra house, also known as "Assam style house," is common in north-eastern India, especially in Assam. Typically, low-weight, locally accessible materials like thatch, bamboo, and wooden planks are used to construct these buildings. Such houses have a proper system of bamboo/wooden beam-column and fulfil the earthquake safety requirements of rectangularity and simplicity. Ikra houses are one-storied buildings with masonry walls made of brick or stone that extend up to a height of around a metre above the plinth. This brickwork serves as a support for bamboo walls that are plastered with cement or mud. The roof, which connects the parallel walls with lateral wood or bamboo trusses, is typically made of GI sheets. The various types of "Ikra Houses" and their Assamese construction style have been shown in **Figure 4.1**.

Figure 4.1: Assam Type 'Ikra' Houses in Dhakuakhana Town, 2022



Source: Primary Survey, SPA Delhi (2022).

Steel angles and flats are fastened to the masonry foundation walls of the bamboo superstructure with bolts and nails. As bamboo is very flexible material and also light weight material, the seismic force in bamboo system is very less compared to modern housing systems. In Dhakuakhana town, most of the "Ikra Houses" can be found near Borpatra Gaon, Amulapatti, Huz Gaon and Konwar Ghahi areas.

4.2.2 Chang house

Typical Mising homes known as a "Kare Okum" or "Chang Ghar" in Assamese can be found all over Dhakuakhana especially in the Konwar Ghahi and Mohguli Chapori areas where the Missing Population stays near the bank of River Charikariya. These kinds of houses are built on stilts made of wooden poles and the rest of the structure is made from vernacular materials like bamboo, thatch, mud, and wood. The Mising tribe of Assam has lived on stilts for generations. The houses are typically elevated to a height of 5-7 stairs leading up to these houses. This style of construction is associated with religious practices and beliefs of the tribe. The spacious hall-style house on stilts has a central kitchen that can accommodate a big joint family. These houses serve the dual purpose of keeping floodwaters and wild animals at bay. They are constructed on an elevated platform supported by bamboo stilts that are at least 10 feet tall. The "Chang Ghar" comprises several layers, from the floor to the ceiling, each of which has a certain function. In the interior of the "Chang Ghar" residence hanging shelves are used to keep things safe from floods. Above the floor there is a traditional fireplace which is called the Meram. The various types of "Chang Ghar" found in Dhakuakhana town have been shown in **Figure 4.2**.

Figure 4.2: Chang Houses of Dhakuakhana Town, 2022



Source: Primary Survey, SPA Delhi (2022).

4.2.3 RCC Houses

Simple, single-story "Assam type" buildings with high earthquake resistant elements were the norm for construction in the whole of Dhakuakhana till late 1990s. Over the last couple of decades, Dhakuakhana has adopted RCC framed buildings as the norm due to the city's increasing urbanization (**see Figure 4.3**). The majority of the multi-storied RCC buildings in the town were just built in the last decade, and as a result, they have not yet been evaluated for their ability to withstand high intensity earthquakes unlike the modest single-story "Ikra" houses with strong earthquake-resistant elements.

Figure 4.3: RCC Houses in Dhakuakhana Town, 2022



Source: Primary Survey, SPA Delhi (2022).

However, due of its improved resistance to accidental fires, such structures with brick masonry and corrugated iron sheet roofs have become more popular. In the modern designs of the houses in Dhakuakhana, the layout of the Assam Type houses is often retained, and the structure is constructed as a multi-storied RCC building. Most of such houses are of detached type with sloping roofs. These houses usually contain one big

living room, two bedrooms, one kitchen and one bathroom. Also, a small veranda in the front and space for car parking inside the structure is also present.

4.2.4 Mud house

Water with various combinations of soil, silt, and clay are combined to form mud. Although not very common, few of these types of houses can be found at various locations in the town. These structures typically have lengths between 5 and 10 metres and widths between 3 and 5 metres for their plans. The structure contains one to two stories. The roofing/flooring system typically spans 3 to 4 metres. The house's length to breadth can be stated as either a 3:1 or a 2:1 ratio. These houses are typically 1-2 storied.

4.3 Housing Condition

The housing condition of a house refers to its level of structural stability. According to the Census of India, "good" housing condition denotes that the dwelling unit requires no repairs, "liveable" indicates that the dwelling unit only requires minor repairs, and "dilapidated" denotes that the dwelling unit requires major repairs or reconstruction, or that the unit has rotted away or has been damaged and is not yet ready to be repaired or rebuilt.

As per the census of 2011, in total there are 3,110 households with a household size of 4.1 persons in the municipal area and 3889 households in the rural areas. There are two types of usage: residence and residence-cum-other-use. Nearly 97.25 percent of the houses in the town are in the first category. The remaining 2.75 percent of households are of the residence-cum-other-use type (see Table 4.1).

Table 4.1: Ward-wise Housing Characteristics of Dhakuakhana Town, 2011

Wards	Residence (percent of households)				Residence-cum-other use (percent of households)			
	Total	Good	Liveable	Dilapidated	Total	Good	Liveable	Dilapidated
Ward 1	98.4	72.2	24.6	1.6	1.6	0.3	1.4	0
Ward 2	98.5	64.9	32.3	1.4	1.5	1.5	0	0
Ward 3	98	33.6	60.1	4.3	2	1	0.9	0.1

Wards	Residence (percent of households)				Residence-cum-other use (percent of households)			
	Total	Good	Liveable	Dilapidated	Total	Good	Liveable	Dilapidated
Ward 4	94.1	31.4	60	2.7	5.9	3.9	2	0
Total	97.25	50.53	44.25	2.5	2.75	1.68	1.08	0.03

Source: Census of India (2011).

When looking at the villages in the planning area, it was found that most of the residences in Kalakata Chetia, Bantow Gaon, Dighala Chapori, No. 1 Ghilaguri, No.2 Ghilaguri, Dighala Hiloi Dhari, Jiamoria Gaon, Gohain Handique, Bhaluka-guri Chapari, Dakhin Chapari, Pithiyal and N.C Simalguri villages are in a livable condition. Out of all the villages, Bantow Pathar, No.2 Ghilaguri and NC Bantow village had the large number of houses in a good condition. When looking at the dilapidated houses, Dullapara bhari. Bantow Chamuah Pathar, Telia Chapari and Bahpara villages have the greatest number of dilapidated houses (See Table 4.2).

Table 4.2: Village-wise Housing Characteristics of Dhakuakhana Town, 2011

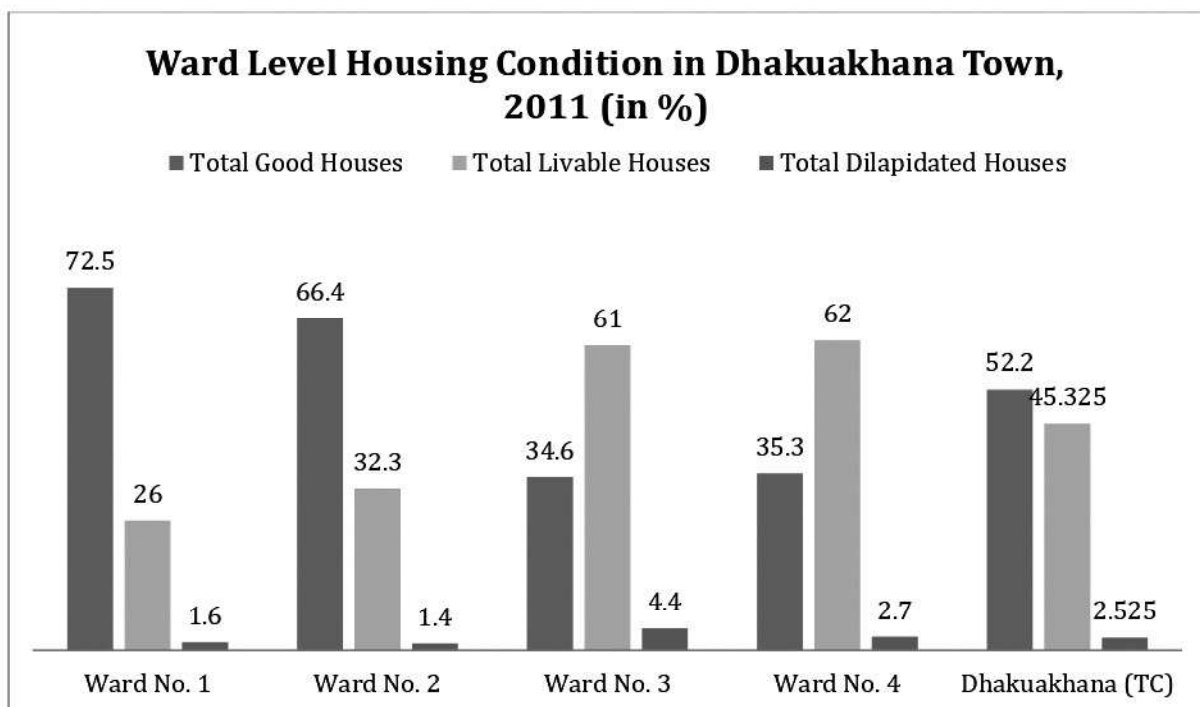
Area Name	Condition of Census Houses							
	Residence				Residence-cum-other Use			
	Total	Good	Liveable	Dilapidated	Total	Good	Liveable	Dilapidated
Kala Kata Chetia	99.5	28.5	61.6	9.4	0.5	0.5	0	0
Gohain Bari	100	16.0	59.7	24.3	0	0	0	0
Bantow Pathar	100	66.7	33.3	0	0	0	0	0
Gohain Bari Pathar	100	75.0	21.9	3.1	0	0	0	0
Dullapara Bhari	100	20.0	47.5	32.5	0	0	0	0
Bantow Gaon	98.7	23.4	65.2	10.1	1.3	0.2	0.9	0.2
Bantow Chamuah Pathar	98.6	20.0	51.4	27.1	1.4	0	1.4	0
Daghala Chapari	100	25.5	70.9	3.6	0	0	0	0
Jarani Chapari	100	0	88.2	11.8	0	0	0	0
No.1 Ghilaguri	100	18.9	75.8	5.3	0	0	0	0
No.2 Ghilaguri	100	66.7	13.3	20	0	0	0	0
Teliachapari	100	0	52.2	47.8	0	0	0	0
Narayanpur Chapari	100	10.6	83	6.4	0	0	0	0
Dighala Hiloi Dhari	100	29.5	66.4	4.1	0	0	0	0
Jiamoria Gaon	100	27.0	69.4	3.6	0	0	0	0
Gohain	99.4	21.3	66.2	12.0	0.6	0	0.3	0.3

Area Name	Condition of Census Houses							
	Residence				Residence-cum-other Use			
	Total	Good	Live-able	Dilapidated	Total	Good	Liveable	Dilapidated
Handique								
Bhalukguri Chapari	100	25	73.2	1.8	0	0	0	0
Dakhin Chapari	100	0	100	0	0	0	0	0
Pithiyal	100	6.7	87	6.3	0	0	0	0
Bahpara	99	25.5	36	37.5	1	0.5	0.5	0
Borhola Chapari	100	0	100	0	0	0	0	0
N.C. Simaluguri	100	19.5	77.3	3.1	0	0	0	0
N.C. Bantow	100	66.7	8.3	25	0	0	0	0
Kuhimari Chapari	0	0	0	0	0	0	0	0
Total (Rural)	95.6	24.7	58.7	12.3	0.2	0.1	0.1	0.0

Source: Census of India (2011).

When looking at the qualitative characteristics of the housing in Dhakuakhana town, it can be observed that nearly 2.53 percent of the houses are in a dilapidated condition, 52.2 percent are in a good condition, and 45.33 percent in a liveable condition as per the Census of India 2011 (see Figure 4.4).

Figure 4.4: Housing Condition in Dhakuakhana Town, 2011 (in percent)

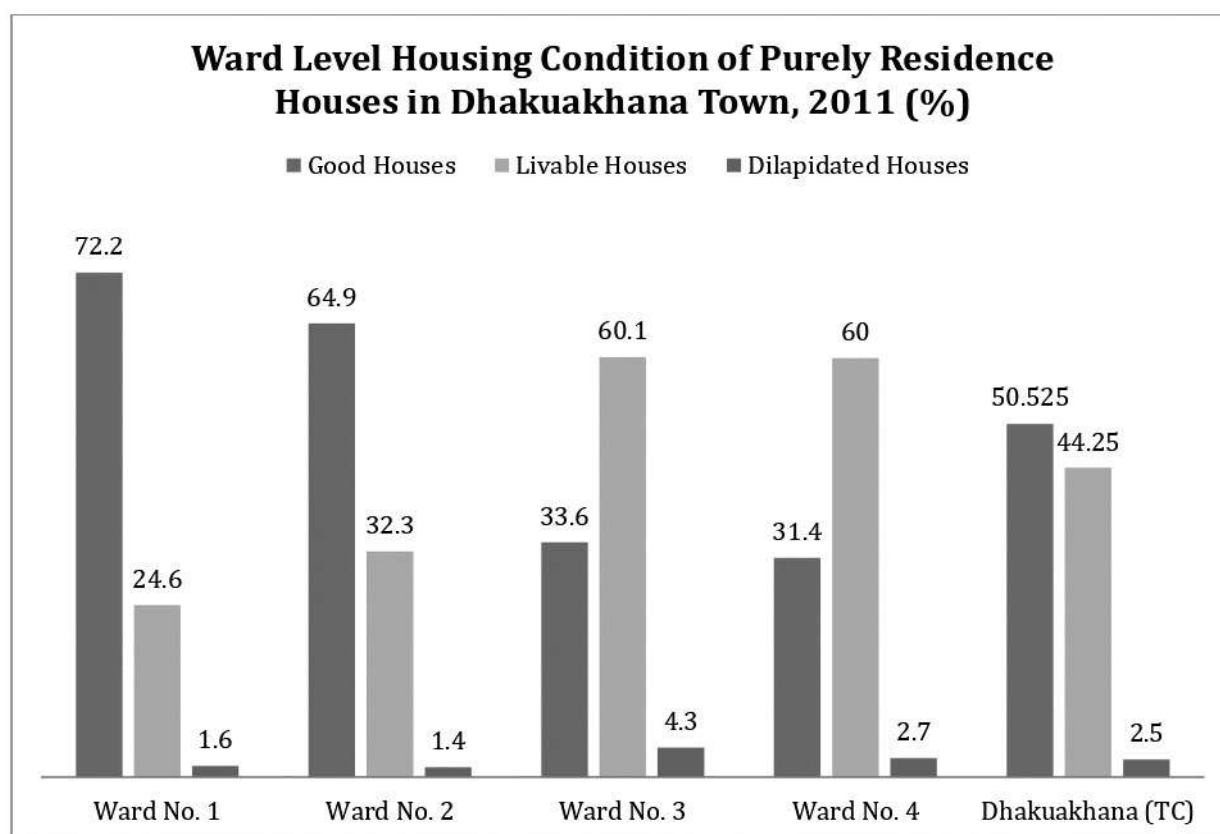


Source: Census of India, (2011).

The ward-level analysis of housing conditions shows that the Ward 1 has the highest good quality houses with 72.2 percent of houses being in a good condition. This is followed by Ward 2 with 66.4 percent of its houses being in a good condition. Ward 3 and Ward 4 have more than 60 percent of their houses in liveable condition. Ward 3 also has the highest of dilapidated houses standing at 4.4 percent of its total. This is followed by Ward 4 with around 2.7 percent of the houses being in a dilapidated condition.

When looking at the purely residential-type houses of the town, it can be observed that nearly 50 percent of the houses are in a good condition and 44.25 percent of houses are in liveable condition. In this category, again, Ward 1 and Ward 2 have the highest of houses in a good condition with 72.2 percent and 64.9 percent of their purely residential houses being in a good condition. In Ward 3 and Ward 3, 60.1 percent and 60 percent, respectively, of their purely residential houses are in a liveable condition (see Figure 4.5).

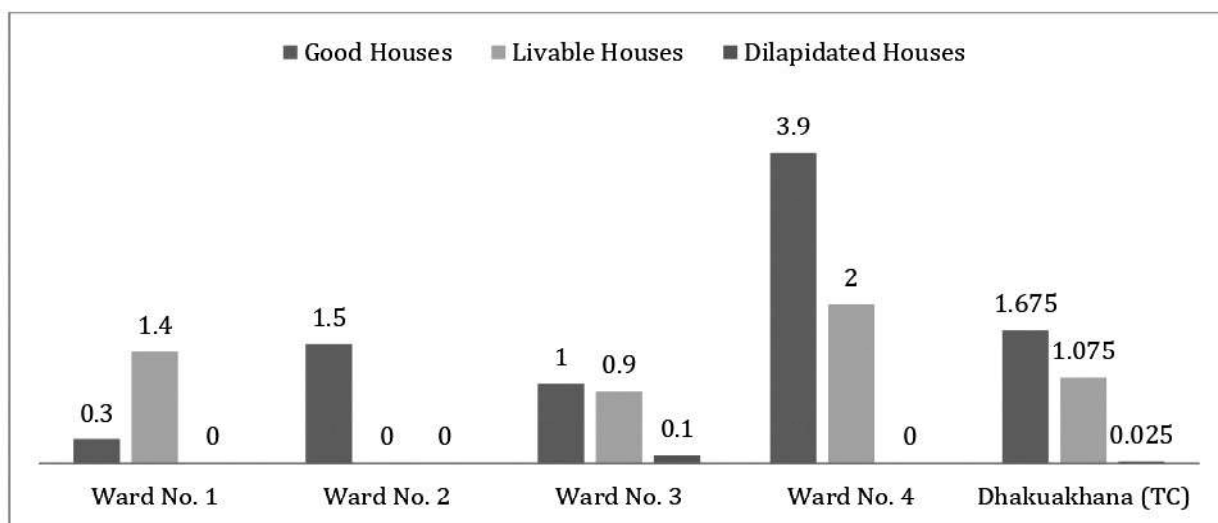
Figure 4.5: Housing Condition of Purely Residence Houses in Dhakuakhana Town, 2011 (in percent)



Source: Census of India (2011).

In the residence-cum-other use category, 1.68 percent of the total houses are in a good condition and 1.08 percent of the houses are in a liveable condition. Nearly 0.03 percent of the houses in this category are in a dilapidated condition. Ward 4 has the maximum of houses in a good condition with 3.9 percent of the houses lying in this category (see Figure 4.6).

Figure 4.6: Housing Condition of Residence-cum-other use Houses in Dhakuakhana Town, 2011 (in Percent)



Source: Census of India (2011).

4.4 Structure of Housing

Houses may be divided into three groups depending on their structural strength, according to the Census of India. These are permanent, semi-permanent, temporary, serviceable, and non-serviceable houses. Permanent houses are buildings with walls and roofs composed of durable materials including concrete, burned bricks, asbestos sheets, G.I., stone, and metal. Walls and roofs of temporary constructions are composed of temporary materials like grass, thatch, bamboo, plastic, polythene, clay, unburned bricks, or wood. In semi-permanent constructions, either the wall or the roof is constructed of permanent materials, while the other is constructed of temporary materials. According to **Table 4.3**, there are 31.90 percent permanent houses, 63.70 percent semi-permanent houses, and 4.10 percent temporary houses in the Dhakuakhana Town Area. 3.80 percent of the houses in the town are non-serviceable.

Table 4.3: Structural Typology of Housing in Dhakuakhana Municipal Area, 2011

Type of Structure	Percent Share
Permanent	31.90
Semi-permanent	63.70
Temporary	4.10
Serviceable	0.30
Non-Serviceable	3.80
Unclassifiable	0.30

Source: Census of India (2011).

As shown in **Table 4.4**, there are only 17.2 percent permanent houses in the entire rural planning area. There are 68.60 percent semi-permanent houses, 14.10 percent temporary houses in the rural area. 14.1 percent of the houses in the villages are non-serviceable and 0.1 percent of the houses are unclassifiable. NC Bantow, Bantow Pathar, and Gohain bari Villages have the greatest number of permanent houses. In Barhola Chapori village, 100 percent of the houses are totally temporary and non-serviceable.

Table 4.4: Structural Typology of Housing of Villages in Dhakuakhana, 2011

Area Name	Structure of Census Houses					
	Permane nt	Semi- Permane nt	Total Tempora ry	Serviceab le	Non- Serviceab le	Unclassifiab le
Bahpara	9.5	84.0	5.0	0.0	5.0	1.5
Bantow Chamuah Pathar	12.9	67.1	20.0	0.0	20.0	0.0
Bantow Gaon	21.3	67.2	11.4	0.0	11.4	0.2
Bantow Pathar	57.6	27.3	15.2	0.0	15.2	0.0
Bhalukguri Chapari	28.6	57.1	14.3	0.0	14.3	0.0
Borhola Chapari	0.0	0.0	100.0	0.0	100.0	0.0
Daghala Chapari	27.3	70.9	1.8	0.0	1.8	0.0
Dakhin Chapari	0.0	82.1	17.9	0.0	17.9	0.0
Dighala Hiloi Dhari	28.0	66.2	5.8	0.0	5.8	0.0
Dullapara Bhari	23.5	67.0	9.0	0.0	9.0	0.5
Gohain Bari	32.0	48.1	19.9	0.0	19.9	0.0
Gohain Bari Pathar	21.9	65.6	12.5	0.0	12.5	0.0
Gohain Handique	21.0	72.3	6.7	0.0	6.7	0.0
Jarani Chapari	0.0	100.0	0.0	0.0	0.0	0.0
Jiamoria Gaon	22.6	58.4	19.0	0.0	19.0	0.0
Kala Kata Chetia	19.1	70.8	10.1	0.0	10.1	0.0
Kuhimari Chapari	0.0	0.0	0.0	0.0	0.0	0.0

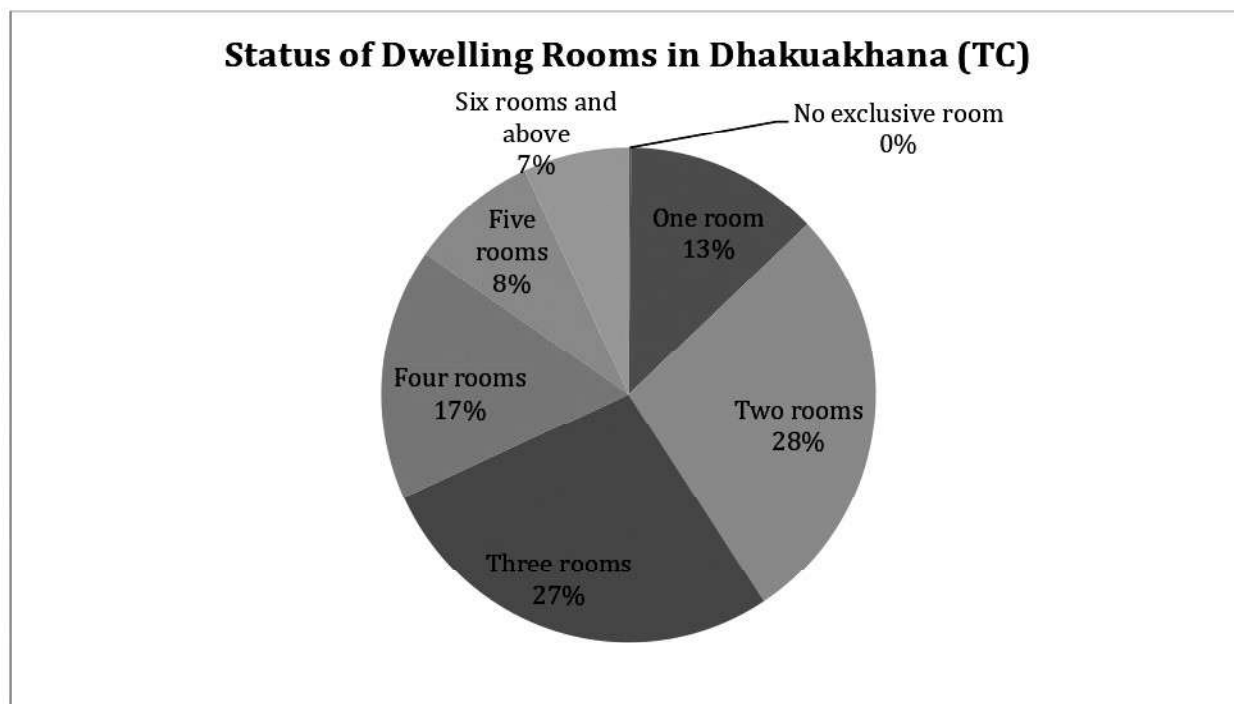
Area Name	Structure of Census Houses					
	Permane nt	Semi- Permane nt	Total Tempora ry	Serviceab le	Non- Serviceab le	Unclassifiab le
N.C. Bantow	41.7	58.3	0.0	0.0	0.0	0.0
N.C. Simaluguri	7.0	87.5	5.5	0.0	5.5	0.0
Narayanpur Chapari	4.3	95.7	0.0	0.0	0.0	0.0
No.1 Ghilaguri	9.5	90.5	0.0	0.0	0.0	0.0
No.2 Ghilaguri	0.0	60.0	40.0	0.0	40.0	0.0
Pithiyal	7.4	90.2	2.1	0.0	2.1	0.4
Teliachapari	0.0	91.3	8.7	0.0	8.7	0.0
Total (Rural)	17.2	68.6	14.1	0.0	14.1	0.1

Source: Census of India (2011).

4.5 Size of Dwelling Units

In Dhakuakhana town maximum numbers of houses have two to three rooms. Around 27 percent of the houses have three rooms and 28 percent of the houses have two rooms. Nearly 17 percent of the houses have four rooms and 13 percent of the houses are a one-room set. Five to six roomed houses are less than 8 percent in the entire town. All the houses in the town have at least one room (see **Figure 4.7**).

Figure 4.7: Status of Dwelling Rooms in Dhakuakhana Town, 2011



Source: Census of India (2011).

When looking at the ward wise breakup of the number of dwelling rooms in the town, Ward 1 has the highest of houses with three rooms, standing at 27 percent of the total share. In Ward 1, 22.7 percent of the houses have two rooms, and 20 percent of the houses have one room. Nearly 14.6 percent of the houses in Ward 1 have 6 rooms and above. In Ward 2, maximum number of houses have two rooms standing at 26.9 percent. 26.1 percent of the houses have three rooms and 21.7 percent of the houses have 4 rooms in Ward 2. In Ward 3, about 56 percent of the houses have two to three rooms, 12.3 percent of the houses have four rooms, 20.6 percent of the houses have only one room and 9.6 percent of the houses have more than five rooms (see Table 4.5).

Table 4.5: Status of Dwelling Rooms in Dhakuakhana Town, 2011

Area Name	No exclusive room	One room	Two rooms	Three rooms	Four rooms	Five rooms	Six rooms and above
Ward 1	0.00	3.8	22.7	27.0	20.0	11.9	14.6
Ward 2	0.10	11.8	26.9	26.1	21.7	10.0	3.4
Ward 3	0.60	20.6	31.5	25.4	12.3	5.0	4.6
Ward 4	0.00	14.6	30.5	31.1	12.0	6.8	5.0
Total	0.18	12.7	27.9	27.4	16.5	8.4	6.9

Source: Census of India (2011).

In the rural areas, most of the households have two to three rooms making up nearly 55 percent of the total households. There are no households with more than four rooms. Jarani Chapari and Pithiyal villages have a small percentage of households having no exclusive room (See Table 4.6).

Table 4.6: Status of Dwelling Rooms in Village of Dhakuakhana Planning Area, 2011

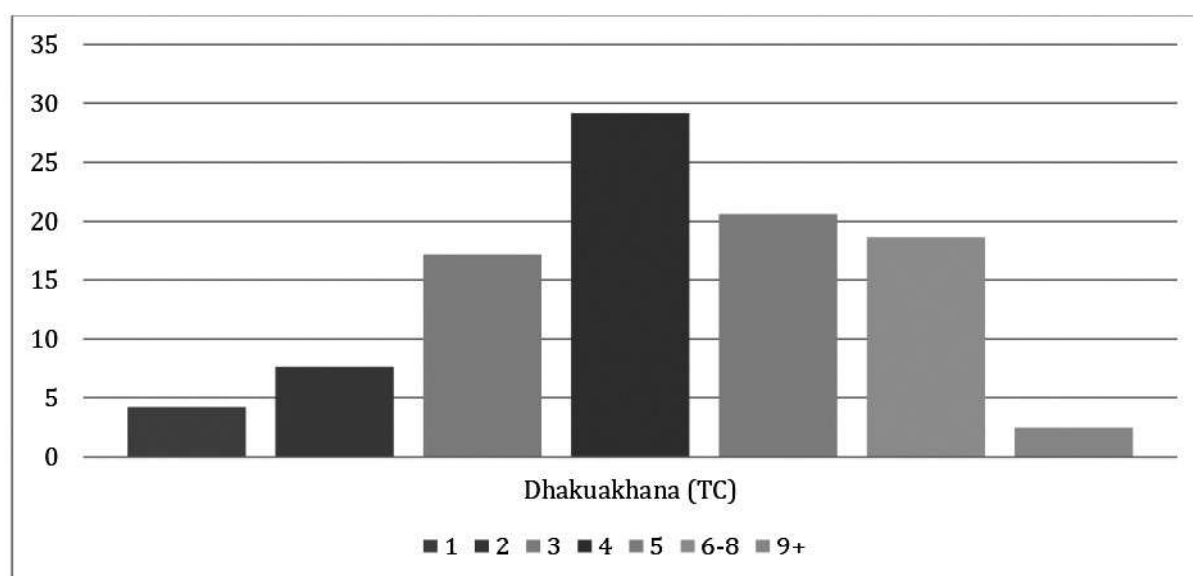
Area Name	Number of Dwelling Rooms						
	No exclusive room	One room	Two rooms	Three rooms	Four rooms	Five rooms	Six rooms and above
Bahpara	0.5	10	48	26.5	11.5	0	3.5
Bantow Chamuah Pathar	0	22.9	31.4	20	15.7	7.1	2.9
Bantow Gaon	0	3.4	25.8	34.1	15.9	13	7.9
Bantow Pathar	0	3	42.4	27.3	12.1	6.1	9.1
Bhalukguri Chapari	0	19.6	42.9	21.4	14.3	1.8	0
Borhola Chapari	0	0	0	100	0	0	0

Area Name	Number of Dwelling Rooms						
	No exclusive room	One room	Two rooms	Three rooms	Four rooms	Five rooms	Six rooms and above
Daghala Chapari	0	14.5	40	27.3	14.5	1.8	1.8
Dakhin Chapari	0	3.6	57.1	17.9	10.7	3.6	7.1
Dighala Hiloi Dhari	0.2	4.8	24.3	40.8	20	5.2	4.6
Dullapara Bhari	0	6	33.5	28.5	17	9	6
Gohain Bari	0	12.7	39.8	24.9	11.6	5.5	5.5
Gohain Bari Pathar	0	6.2	15.6	46.9	15.6	6.2	9.4
Gohain Handique	0	4.4	21.9	37.6	15.5	11.4	9.3
Jarani Chapari	5.9	76.5	17.6	0	0	0	0
Jiamoria Gaon	0	3.2	25.2	34.6	23.4	7	6.6
Kala Kata Chetia	0.2	1.4	20.3	27.3	27.5	11.4	11.8
Kuhimari Chapari	0	0	0	0	0	0	0
N.C. Bantow	0	0	41.7	16.7	33.3	0	8.3
N.C. Simaluguri	0	2.3	31.2	34.4	21.9	9.4	0.8
Narayanpur Chapari	0	2.1	44.7	21.3	14.9	10.6	6.4
No.1 Ghilaguri	0	56.8	29.5	9.5	4.2	0	0
No.2 Ghilaguri	0	60	26.7	6.7	6.7	0	0
Pithiyal	2.8	66	25.6	2.8	1.8	0.7	0.4
Teliachapari	0	39.1	26.1	17.4	8.7	4.3	4.3
Total (Rural)	0.4	17.4	29.6	26.0	13.2	4.8	4.4

Source: Census of India (2011).

4.6 Household Size

In Dhakuakhana town, the maximum numbers of households have a family size of 4, as per Census of India 2011. Nearly 29.18 percent of the households have a family size of four, 20 percent of households have a family size of 5, 18.7 percent of households have a family size of 6-8, and 17.13 percent of households have a family size of 3. Less than 2.5 percent of households have a family size of 9 and above. Nearly 4.25 percent of households have a single person living in them and 7.6 percent of households have 2 persons as the family size as (see Figure 4.8).

Figure 4.8: Household Size in Dhakuakhana Town (Percent), 2011

Source: Census of India (2011).

When looking at the ward wise break-up of household sizes, in Ward 1, about 34.6 percent of the households have a family size of 4, around 21.1 percent of the households have a family size of 5, about 17.8 percent of the households have a family size of 6-8, and 3 percent of the households have a family size of 9 and above. Ward 3 has the most of families having 6-8 household sizes. Ward 4 has 9.65 percent of its households having a family size of two, the highest amongst all wards (see Table 4.7).

Table 4.7: Household Size in Dhakuakhana Town (in percent), 2011

Area Name	Household Size						
	1	2	3	4	5	6-8	9+
Ward 1	2.2	5.7	15.7	34.6	21.1	17.8	3.0
Ward 2	3.0	6.6	19.2	32.0	19.7	17.5	2.0
Ward 3	6.5	8.8	17.4	23.1	20.1	20.9	3.2
Ward 4	5.2	9.6	16.2	27.0	21.6	18.6	1.8
Total	4.23	7.68	17.13	29.18	20.63	18.7	2.5

Source: Census of India (2011).

There are a total of 3,013 households in the municipal area and 3889 households in the rural area. So, the average household size is 4.34 in municipal area and 4.64 in the rest of the planning area. The total area of the town is 12.58 sq. km and the total planning area is 61.24. The ward-wise household data is provided in Table 4.8.

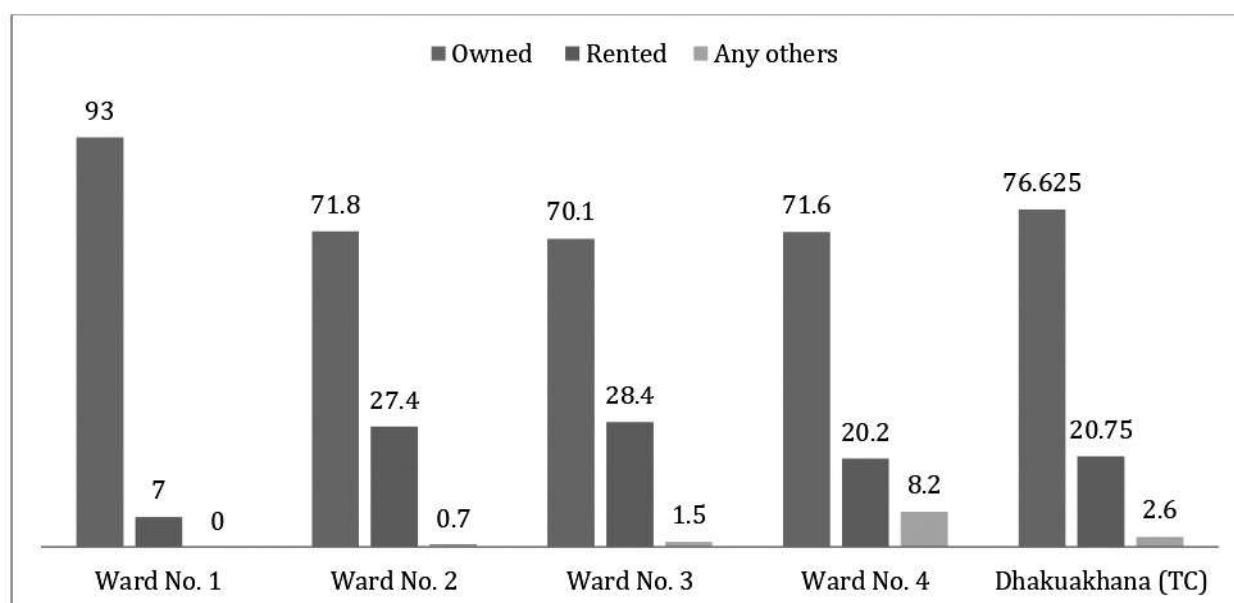
Table 4.8: Ward-wise Number of Households in Dhakuakhana, 2011

Ward	Number of Households
Ward 1	260
Ward 2	324
Ward 3	246
Ward 4	333
Ward 5	280
Ward 6	326
Ward 7	287
Ward 8	341
Ward 9	249
Ward 10	367
Total (Urban)	3,013
Total (Rural)	3,889
Total Planning Area	6,902

Source: Dhakuakhana Municipal Board (2022).

4.7 Housing Ownership

In Dhakuakhana town, 76.63 percent of the households are owned houses while 20.75 percent of the households are rented. 2.6 percent of the household in the town are neither owned nor rented (see **Figure 4.9**).

Figure 4.9: Ownership Status of Households in Dhakuakhana (Percent), 2011

Source: Census of India (2011).

Coming to the status of housing ownership break-up at the ward level, Ward 1 has the highest number of owned houses which is nearly 93 percent. In Ward 2, nearly 71.8 percent of the houses are owned houses and 27.4 percent of the houses are rented. In Ward 3, around 70 percent of the houses are owned, and 28.4 percent of the houses are rented. Similarly, in Ward 4, about 71.6 percent of the houses are owned and 20.2 percent of the houses are rented. Ward no.4 has nearly 8.2 percent of households that are neither owned nor rented (see **Table 4.9**).

Table 4.9: Ownership Status of Houses in Dhakuakhana, 2011

Area Name	Ownership Status in Percent		
	Owned	Rented	Any others
Ward 1	93.00	7.00	0.0
Ward 2	71.80	27.40	0.7
Ward 3	70.10	28.40	1.5
Ward 4	71.60	20.20	8.2
Total	76.63	20.75	2.6

Source: Census of India (2011).

4.8 Housing Demand

Housing demand is the number of houses that need to be constructed to accommodate the entire population of the planning area. It includes calculation of dilapidated housing which is structurally unfit and needs major repairs, or reconstruction. It also includes

congested households defined as households having no separate room for married couples. Further it includes the requirement of housing for the homeless population. As per Census of India 2011, total housing demand for Dhakuakhana Municipal Area is 975 **(see Table 4.10)**. As reported by Dhakuakhana Municipal Boards, there is no homeless population in the planning area. Housing demand is nearly 13.93 percent of total housing stock. Dilapidated houses have the maximum proportion in the housing demand. It amounts to nearly 53 percent of the total housing demand.

Table 4.10: Housing Stock in Dhakuakhana Planning Area, 2011

Housing Stock	6,999
Dilapidated Houses	520
Congested Households	455
Requirement for Homeless	0
Housing Demand	975

Source: Census of India (2011).

4.9 PMAY-U Housing Provision

The Indian government's Pradhan Mantri Awas Yojana-Urban (PMAY-U) initiative was launched in 2015 by the Ministry of Housing and Urban Affairs (MoHUA). By guaranteeing a pucca residence for all qualified urban families by 2022, the Mission aims to alleviate the urban housing issue among EWS, LIG, and MIG groups, including slum residents. Under this scheme, a total amount of 2 lakhs is given to each individual beneficiary in three instalments of 80000, 90000 and 30000 each. The beneficiaries are landowners of EWS category who have a yearly income of less than 3 lakhs or monthly income of less than 25000 and don't have a pucca house.

According to the report provided by the Dhakuakhana Municipal Board in March 2022, a total of 194 dwellings have been built in Dhakuakhana town so far under PMAY-U, and an additional 694 are under construction. The target beneficiaries for the scheme are 3037 according to the 1st, 2nd, 3rd and 4th DPR. Till March 2022, 737 beneficiaries had received the 1st instalment, 579 beneficiaries had received the second instalment, and 172 beneficiaries had received the third instalment. The town needs to make provisions for 1549 more beneficiaries based on the target beneficiaries for 2022. **Table 4.11**

displays the stage-by-stage physical state of the PMAY-U-assisted homes in Dhakuakhana town.

Table 4.11: Provision of Houses under Pradhan Mantri Awas Yojana in Dhakuakhana Town, 2022

Total Target Beneficiaries (DPR-wise)	1st DPR	164
	2nd DPR	823
	3rd DPR	481
	4th DPR	1,569
	Total	3,037
No. of Beneficiaries who Received the Fund	1st instalment (80000)	737
	2nd instalment (90000)	579
	3rd instalment (30000)	172
	Total	1,488
Stage wise Physical Status of Construction (Total Geo-tagging report as on Bhuvan Portal)	Complete Stage	194
	Roof Stage	215
	Lintel Stage	479
	Foundation Stage	633

Source: Dhakuakhana Municipal Board (2022).

4.10 Conclusions

In Dhakuakhana town, the maximum houses are either in a good or liveable condition keeping in mind their quality and usability. A small percentage of the households are in a dilapidated condition, most of which lie in Ward 3 and 4. There is a need for renovation of these houses to improve their existing conditions. Most of the people in the town live in their own houses and a small percentage live in rented houses. Ward 2 and 3 have the greatest number of people living in rented houses. Most of the people in the town have a household size of 4 persons and a dwelling unit size of 2 to 3 rooms. The housing demand needs to be assessed to identify the housing shortage in the town.

CHAPTER 5: TRAFFIC AND TRANSPORTATION

5.1 Introduction

To assess the traffic and transportation system characteristics of a region, scientific traffic surveys and studies within the study area are required to establish the baseline status and identify problems and issues. Data collection activities included classified traffic volume counts, origin-destination surveys, and parking survey was conducted to assess the passenger and goods movement patterns. Further, data was collected from secondary sources like google maps to access the road network inventory and speed and delay of transits.

5.2 Survey executed

From March 28 to March 30, 2022, the School of Planning and Architecture, New Delhi (2022) performed primary surveys. These assessments focused specifically to the movement of passengers and goods throughout Dhakuakhana. The survey's findings are shown below:

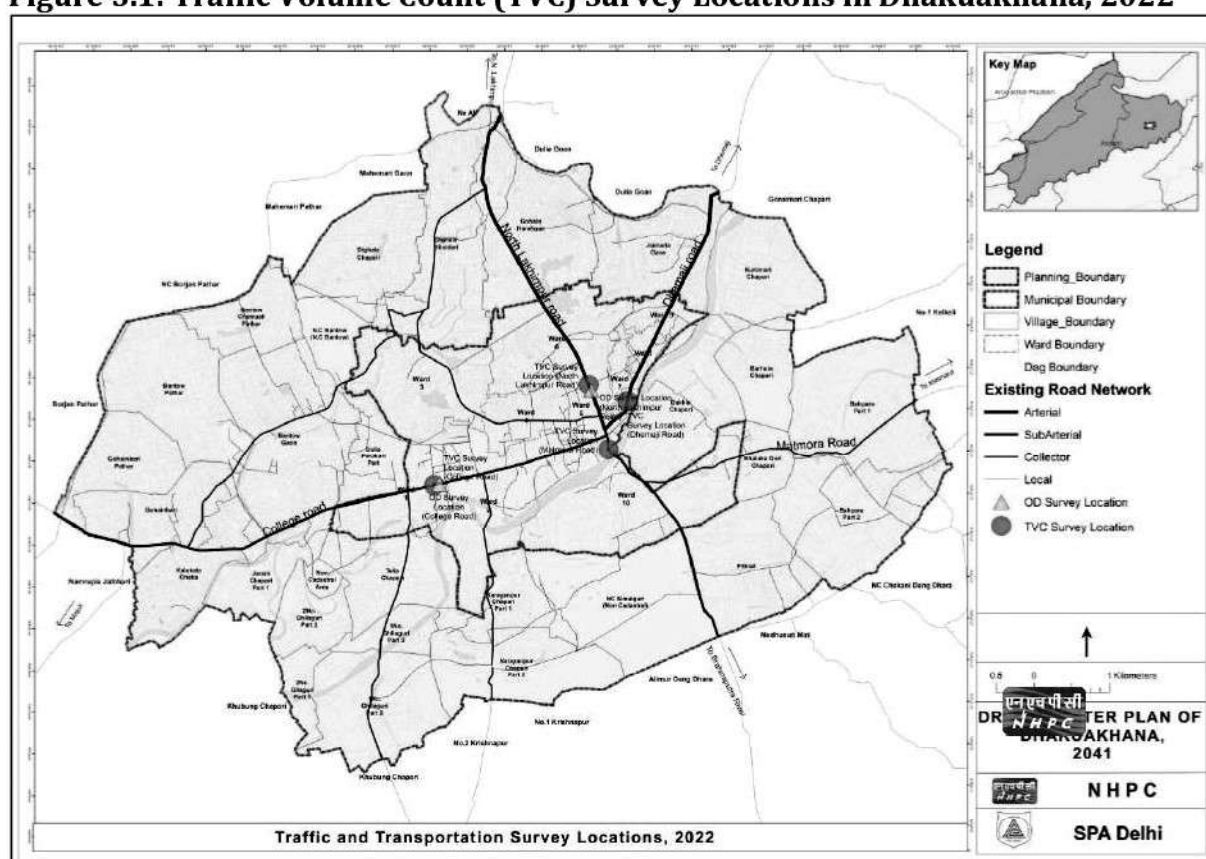
5.2.1 Classified traffic volume count survey

Classified traffic volume count is the counting of the number of vehicles passing through a road over a period. Classified Traffic Volume Count Surveys were conducted to appreciate the traffic characteristics in terms of average daily traffic, traffic composition, peak hour traffic and directional split at each survey location at the inner cordon. These vehicles are further categorized based on their PCU values. It is defined as the procedure to determine mainly volume of traffic moving on the roads at a particular section during a particular time. It is usually expressed in terms of Passenger Car Unit (PCU). PCU is a metric used to assess traffic-flow rates on a highway. A Passenger Car Unit is a measure of the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single standard passenger car. This is also known as passenger car equivalent (E-surveying, 2022). Traffic Volume Count Surveys were conducted at 4 locations in both directions for 8-9 hours duration. Further details are numerated in the table below:

Table 5.1: Details of Surveys Carried out in Dhakuakhana.

S. No.	Road name	Direction	Survey duration in Hours	Time
1.	Dhemaji road	Towards Dhakuakhana	8	9:30 am- 5:30 pm
2.		Towards Dhemaji		
3.	North Lakhimpur road	Towards Dhakuakhana	9	8:30 am- 5:30 pm
4.		Towards North Lakhimpur		
5.	Matmora road	Towards Dhakuakhana	8	9:30 am- 5:30 pm
6.		Towards Tiniali		
7.	College road	Towards Dhakuakhana	9	8:30 am- 5:30 pm
8.		Towards Majuli		

Source: SPA New Delhi (2022)

Figure 5.1: Traffic Volume Count (TVC) Survey Locations in Dhakuakhana, 2022

Source: SPA New Delhi (2022)

Traffic Volume Count was conducted in four locations at N. Lakhimpur Road, College Road, Dhemaji Road and Matmora Road. The first road connects N. Lakhimpur to Dhakuakhana. The second survey road connects Dhakuakhana to Majuli and third and fourth road connects Dhakuakhana to Dhemaji and Tiniali to Dhakuakhana respectively (see Figure 5.1).

shows the details of surveys carried out in Dhakuakhana. To calculate the PCU value, and to determine peak hour, specific PCU values are multiplied with number of that specific vehicle which passes through the survey check post. The counting of vehicles is done for both incoming and outgoing.

Table 5.2: Passenger Car Unit (PCU) Values as per IRC 106-1990

Types of Vehicles	Passenger Car Unit (PCU)
Two-wheeler	0.75
Car	1.00
Auto/ taxi	2.00
L.C.V	1.40
Tempo	1.00
Truck	2.20
Six axle trucks	5.00
Bus	2.20
Others	4.00
Cycle	0.50
Carts	2.00

Source: Indian Road Congress, 1990

5.2.2 Origin and destination survey

The primary goal of the origin and destination surveys was to gather data on the movement patterns of passengers and goods at the survey locations as well as travel preferences in terms of destinations within and outside the study area. Two locations were used to conduct the origin and destination survey. The survey was carried out using a random sample of roadside interviews this survey was carried out on March 30 2022 by SPA New Delhi team (see Table 5.2 and Figure 5.1).

5.3 Traffic and travel characteristics

5.3.1 Road network characteristics

To evaluate the current capacity of the roads, the level of service provided, recognize any constraints, and assess the potential for improvement and up-grading of the road network in order to accommodate the current and projected demand of traffic, it is crucial to have a thorough understanding of the characteristics of the road network.

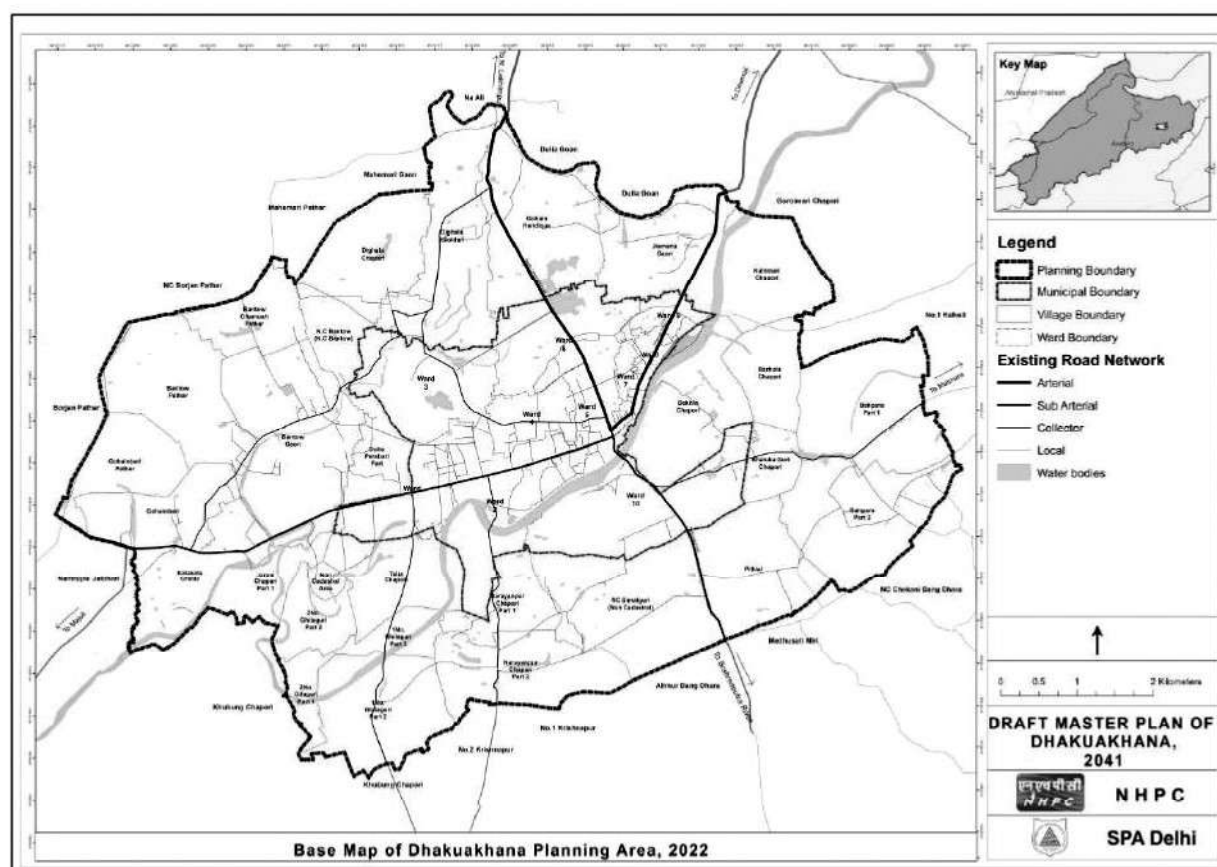
Figure 5.2 shows the primary road network of the study area with a total length of 9.9 kms. **Table 5.3** shows the salient road network characteristics of the primary road network length. The RoW varies between 18 m to 15 m.

Table 5.3: Road Network Characteristics of Major Roads in Dhakuakhana, 2022

Road name	Length (Kms)	ROW (in meter)	Number of lanes
North Lakhimpur road	4.5	11	2
College road	7.6	11	2
Dhemaji road	3.8	11	2
Matmora road	3.3	11	2
Total	17.7	-	-

Source: SPA New Delhi (2022).

Figure 5.2: Existing Road Network of Dhakuakhana, 2022



Source: SPA New Delhi (2022).

5.3.2 Speed and delay characteristics

Any study involving transportation must include speed and delay surveys. The survey provides information on a variety of topics, including travel speed, average delays, trip

times, the reasons for delays, average link lengths, etc. Using Google Map, a speed and delay analysis were conducted. **Table 5.4**, shows the speed and delay profile of passenger and goods traffic within Dhakuakhana. The speed range between 43 km per hour (kmph) to 30 kmph during the peak hour. Since most of the traffic is along North Lakhimpur road, so around 2.3-minute delay can be observed during the peak hour.

Table 5.4: Speed and Delay Profile in Dhakuakhana, 2022

Road name	Length (Kms)	Journey Speed (in kmph)		Delay (in minutes)
		Typical	Peak hour	
North Lakhimpur road	4.5	47	31	2.3
College road	7.6	45	33	3.8
Dhemaji road	3.8	35	32	0.7
Matmora road	1.8	35	35	0.0

Source: SPA New Delhi (2022)

5.3.3 Average daily traffic

A total traffic volume of 27,109 PCUs enter and leave study area daily within duration of 8-9 hours. Most of the traffic volume can be observed along the North Lakhimpur road say nearly 34.5 percent and the highest traffic volume can be observed along the North Lakhimpur road towards Dhakuakhana. Whereas the lowest traffic can be seen on Matmora road towards Matmora. Further, the average daily entering and exiting traffic recorded at the survey locations is shown in **Table 5.5**.

Table 5.5: Daily Traffic Volume within Dhakuakhana, 2022

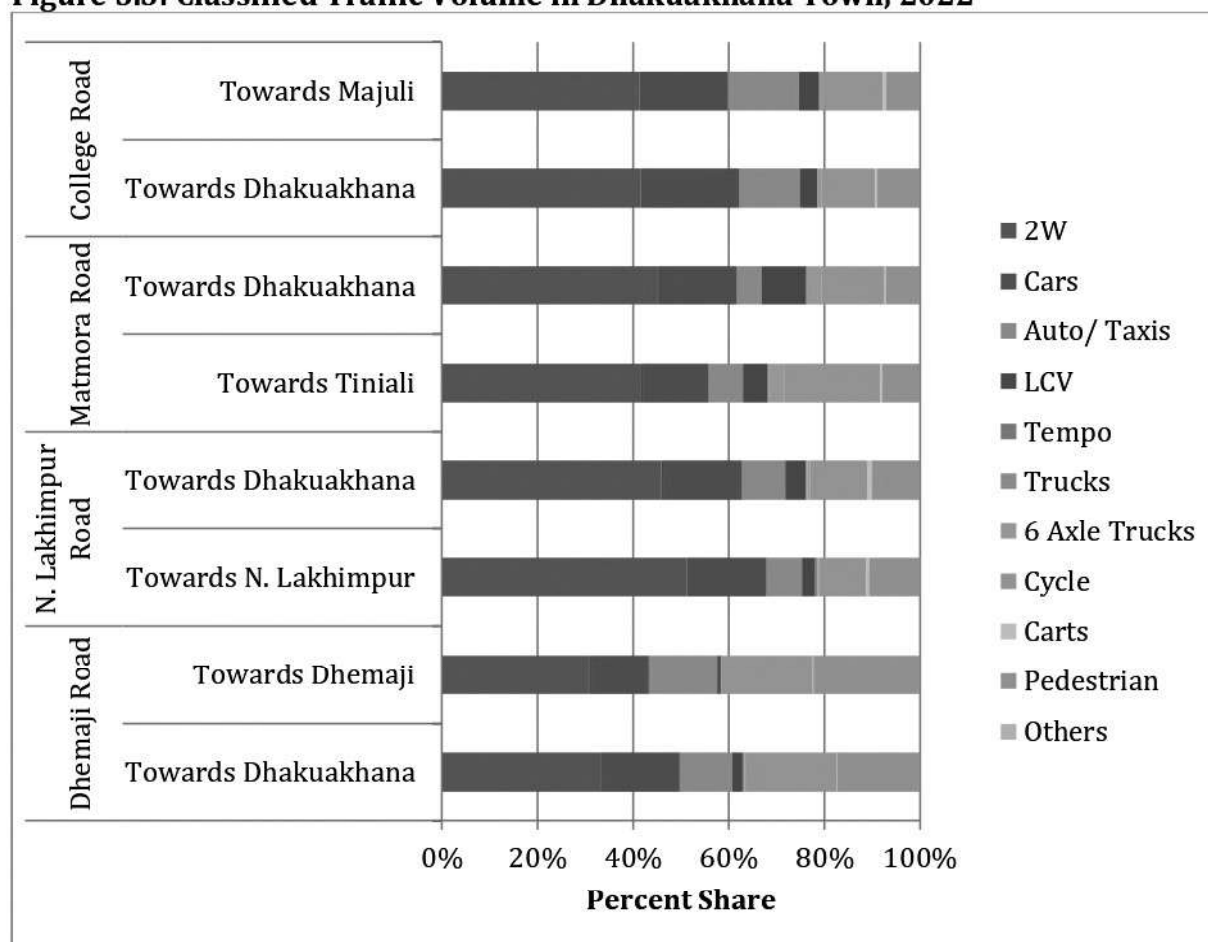
Survey Locations	PCU		Directions	PCU	
	Number	Percent		Number	Percent
Dhemaji Road	6,565	24.2	Towards Dhakuakhana	3,582	13.2
			Towards Dhemaji	2,983	11.0
N. Lakhimpur Road	9,361	34.5	Towards N. Lakhimpur	4,443	16.4
			Towards Dhakuakhana	4,918	18.1
Matmora Road	4,703	17.3	Towards Matmora	1,913	7.1
			Towards Dhakuakhana	2,790	10.3
College Road	6,480	23.9	Towards Dhakuakhana	3,647	13.5
			Towards Majuli	2,833	10.5
Total	27,109	100		27,109	100.0

Source: SPA New Delhi (2022)

5.3.4 Traffic composition

Most recurring vehicle type was two wheelers for both routes; however, cars and auto/taxi traffic were also found on all the four roads. 6 Axle Truck movements was more on Matmora Road. Percentage of Light Commercial Vehicles (LCV) was almost 10% on Matmora Road and around 4-5% on other three roads. Cycle movement was evenly distributed so does the Cart movement. Truck movement was more on N. Lakhimpur Road (see Figure 5.3).

Figure 5.3: Classified Traffic Volume in Dhakuakhana Town, 2022



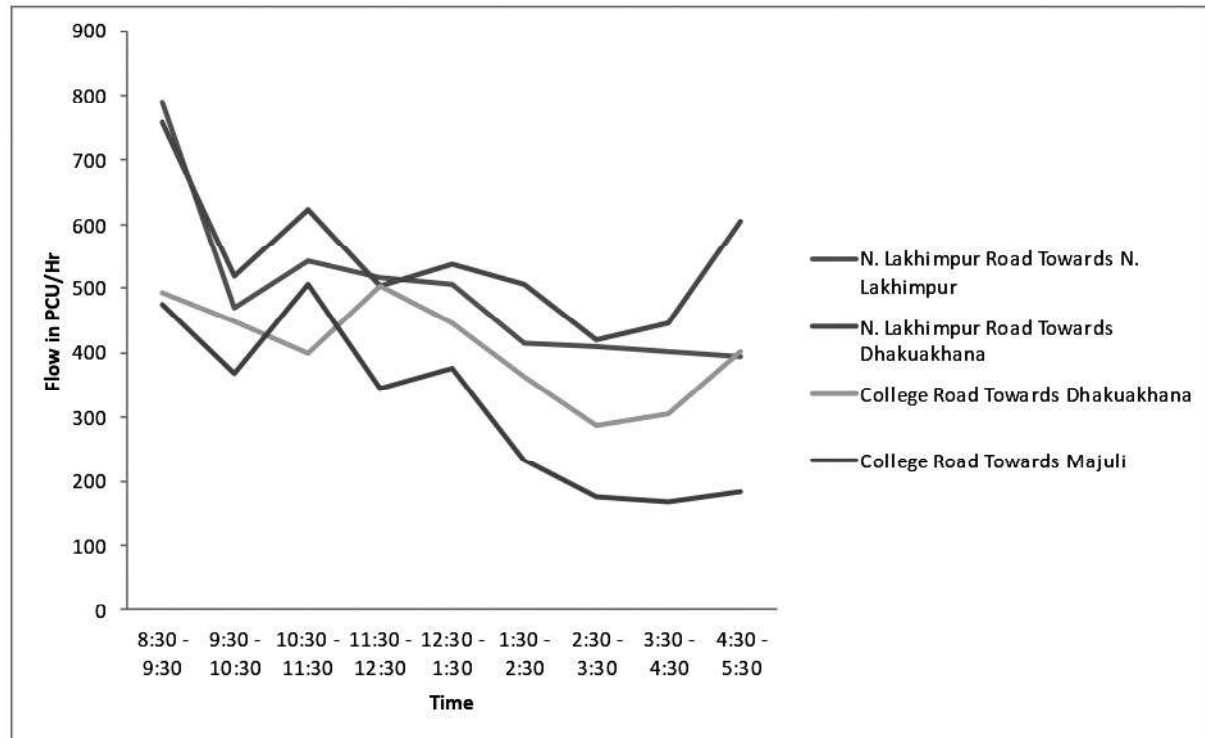
Source: SPA New Delhi (2022).

5.3.5 Hourly variation

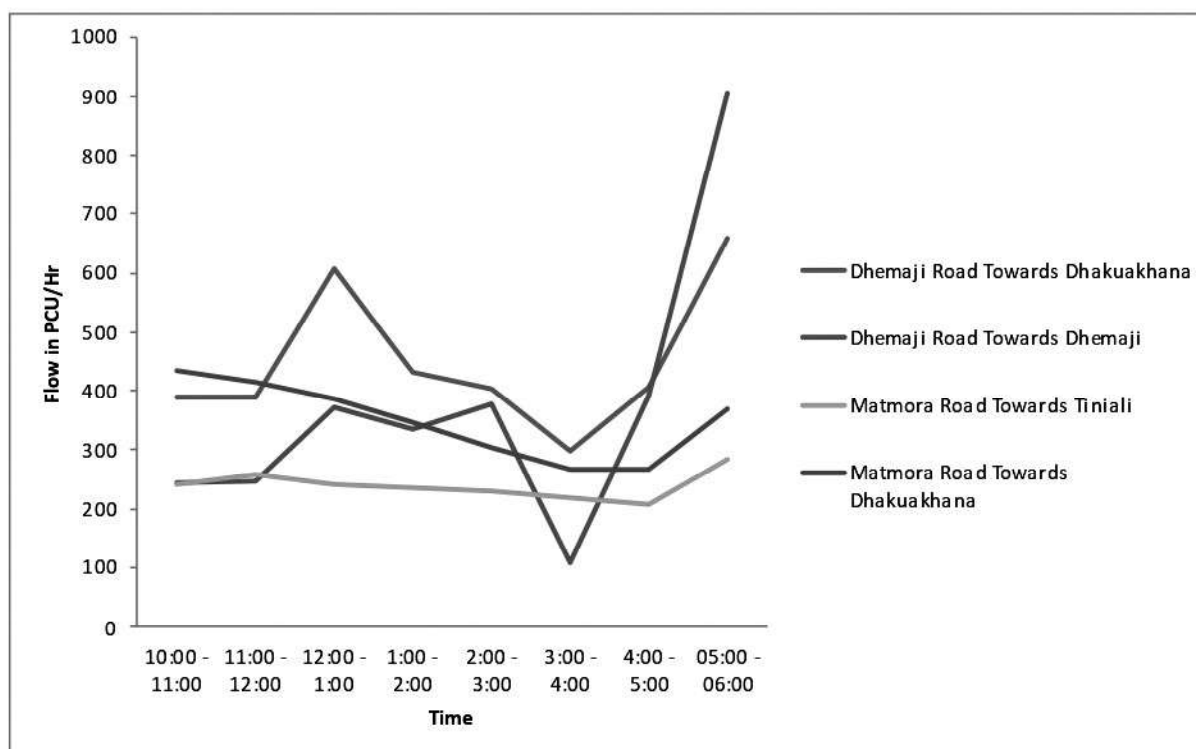
Findings of Traffic Volume Count (TVC) survey reveal heavier traffic on the Dhemaji Road (towards Dhemaji) with PCU value of 907 PCU/hour at the hours between 05:00 P.M.-06:00 P.M. while peak hour for Dhemaji Road (towards Dhakuakhana) was also between 05:30 P.M.-06:00 P.M. with a PCU value of 658 PCU/hour. The lowest traffic was found on Matmota Road (towards Tiniali) which was highest with 284 PCU/hour in

the evening hours of 05:00 P.M.-06:00 P.M. At the same road, for traffic towards Dhakuakhana, the PCU value was 435 PCU/hour between at 10:00-11:00 A.M. hour (see Figure 5.5)

Figure 5.4: Traffic Volume count on N. Lakhimpur Road and College Road



Source: SPA New Delhi (2022).

Figure 5.5: Traffic Volume Count along Dhemaji Road and Matmora Road

Source: SPA New Delhi (2022).

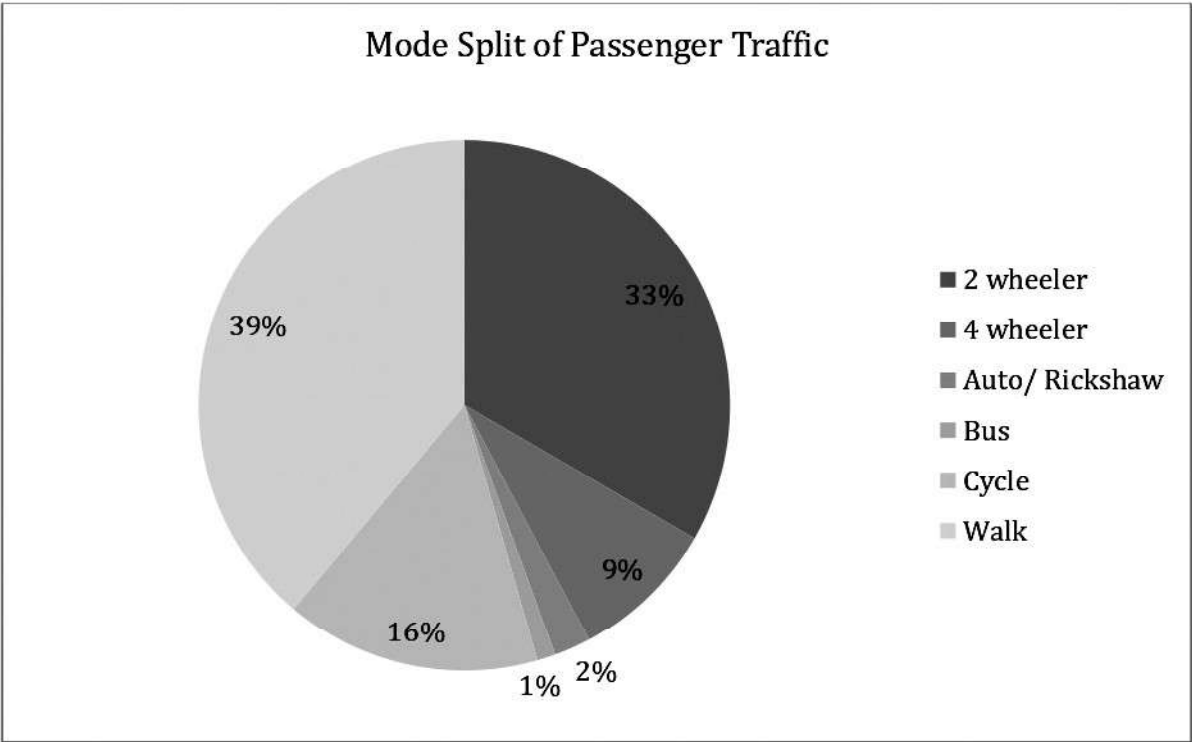
Findings of TVC survey on N. Lakhimpur Road and College Road reveals heavier traffic on the N. Lakhimpur Road (towards Dhakuakhana) with the highest PCU value of 604 PCU/hour at the hours between 04:30 P.M.-05:30 P.M. while peak hour for College Road (towards Majuli) was between 10:30 A.M.-11:30 A.M. with a PCU value of 507 PCU/hour. Between N. Lakhimpur and College, the lowest traffic was found on College Road (towards Majuli) which was highest with 474 PCU/hour in the morning hours of 08:30 A.M.-09:30 A.M and decreased as time progressed. At the same road, for traffic towards Dhakuakhana, the PCU value was 503 PCU/hour between at 11:30 A.M.-12:30 P.M. hour (see Figure 5.5 and 5.6).

5.4 Desire pattern of passenger traffic

5.4.1 Mode of travel

Primary survey revealed that due to the smaller size of the town, most of the passenger trips within Dhakuakhana are based on walking and cycling (say 55 percent of the trips) and lesser dependency on buses and other public transportation system. In contrast, 42 percent of trips are carried out in personal vehicles, either two or four wheels. Figure 5.6 shows the modal share of passenger trips within Dhakuakhana.

Figure 5.6: Mode Split of Passenger Traffic in Dhakuakhana, 2022

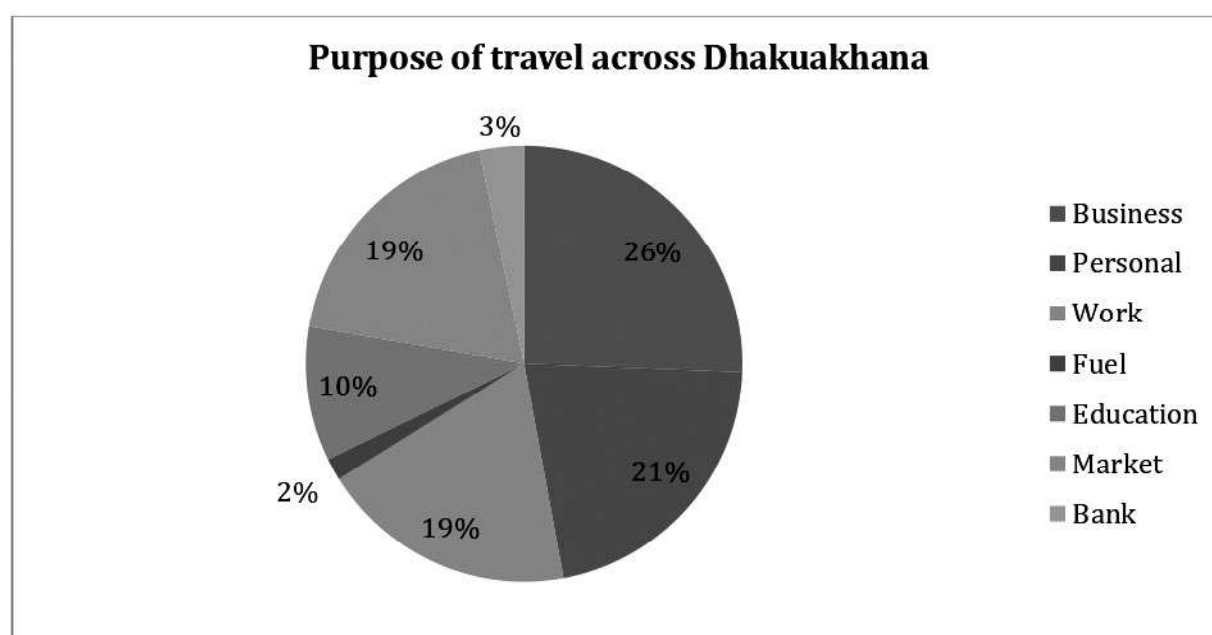


Source: SPA New Delhi (2022).

5.4.2 Purpose of travel

Around 45 percent of the trips captured at survey locations are work and business-related trips, followed by 24 percent market, fuel and bank trips. Further, 21 percent are personal trips followed by 10 percent education related trips.

Figure 5.7 shows the purpose of passenger trips within Dhakuakhana. **Table 5.6** further comprehends the purpose of trips generated at various survey locations.

Figure 5.7: Purpose of Passenger Travel in Dhakuakhana, 2022

Source: SPA New Delhi (2022)

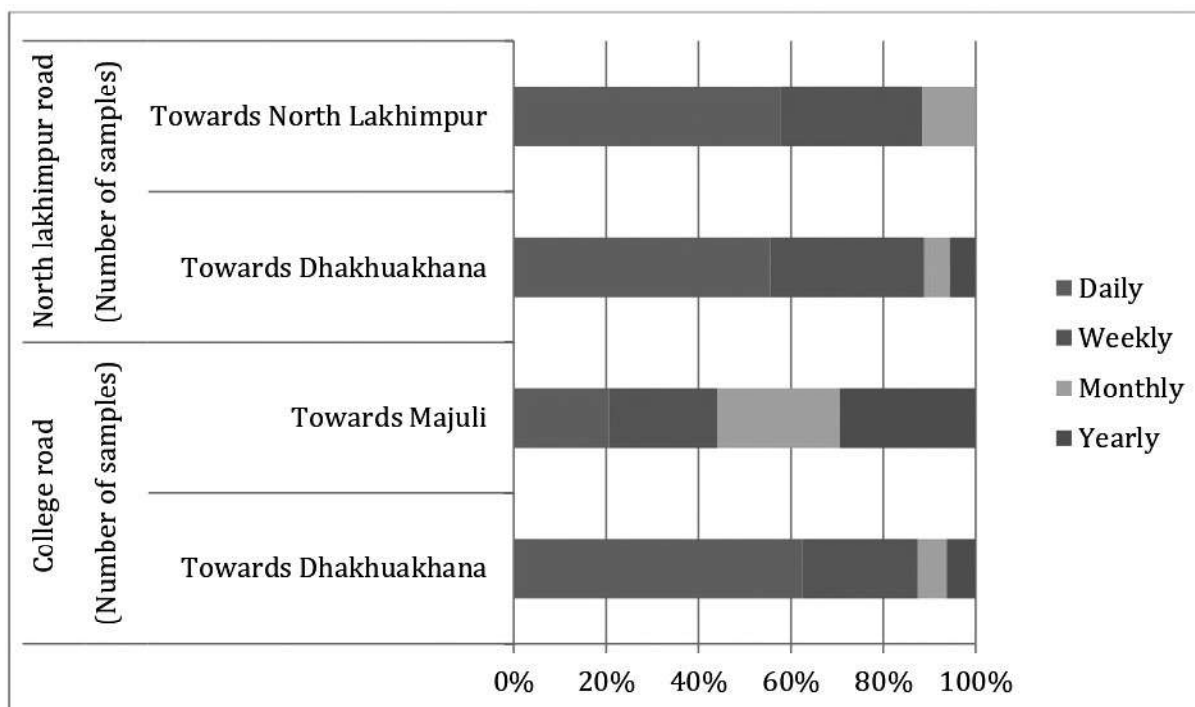
Table 5.6: Purpose of Travel at Respective Survey Locations, 2022

	North Lakhimpur Road (in percent)		College Road (in percent)	
	Towards North Lakhimpur	Towards Dhakuakhana	Towards Majauli	Towards Dhakuakhana
Business	41	0	44	0
Personal	20	19	19	32
Work	20	19	4	36
Fuel	4	0	0	0
Education	7	4	11	23
Market	7	46	22	9
Bank	2	12	0	0
	100	100	100	100

Source: SPA New Delhi (2022)

5.4.3 Frequency of Trip distribution

As per the outcomes of the survey carried, amongst the total trips captured around 50 percent trips along North Lakhimpur road (Towards North Lakhimpur and towards Dhakuakhana) occur on daily basis. Further, more than 60 percent of the trips along the college road towards Dhakuakhana occur on daily basis. Livelihood, economic opportunities, and education are the major reason of daily trips within and across Dhakuakhana. **Figure 5.8** shows the frequency of trip distribution at various survey locations.

Figure 5.8: Frequency of Trip Across Dhakuakhana, 2022

Source: SPA New Delhi (2022)

5.4.4 Physical characteristics of road

As per the outcomes of primary surveys it was evident that the town lacks enough hard surfaced bitumen roads, and the road widths are relatively narrow, which appear to satisfy the existing traffic capacity but may not be enough for future traffic flow. There is no scope for road development besides some of the main roads.

As per Dhakuakhana town committee, total paved length within Dhakuakhana is 38,056 meters. Nearly 42 percent earthen roads are present followed by 23 percent gravel road, 17.5 percent bitumen road and so on. **Table 5.7** shows comprehend further road characteristics within Dhakuakhana.

Table 5.7: Characteristics of Roads within Dhakuakhana

Material of road	Road length		Road width in meter
	in meter	in percent	
Bitumen	6,667	17.5	9.75-5.20
Earthen	16,044	42.2	10.00-1.00
Gravel	8,905	23.4	7.00-3.00
Interlocking	283	0.7	6
WBM II	1,326	3.5	5.3
Bitumen and Earthen	1,536	4.0	7.4
Bitumen and WBM II	971	2.6	6.25

Material of road	Road length		Road width in meter
	in meter	in percent	
Interlocking and Gravel	784	2.1	9
WBM and Gravel	1,540	4.0	5
Total	38,056	100.0	-

Source: Evaluated from the list of roads under Dhakuakhana town committee, 2022.

Figure 5.9: North Lakhimpur Road



Source: SPA New Delhi (2022)

Figure 5.10: Matmora Road



Source: SPA New Delhi (2022).

Figure 5.11: Matmora Road

Source: SPA New Delhi (2022)

Figure 5.12: Dhemaji Road

Source: SPA New Delhi (2022)

Figure 5.13: College Road

Source: SPA New Delhi (2022)

Figure 5.14: Local Street Connecting North Lakhimpur Road

Source: SPA New Delhi (2022)

Figure 5.15: Collector Road Connecting College Road

Source: SPA New Delhi (2022)

5.5 Conclusions

The fact that Dhakuakhana is connected to major towns like Gogamukh, Dhemaji, North Lakhimpur, Majuli, Silapathar, and Dibrugarh via Dhemaji provides an essential link for the transportation of freight and everyday passengers. The development of a reliable and effective road network for the region is a major problem when designing Dhakuakhana since it must take future freight and commuter traffic as well as the majority of the traffic volume may move through the region's consideration. Another major issue is that the town typically lacks an appropriate road hierarchy and scope of expansion.

CHAPTER 6: WATER SUPPLY AND DRAINAGE

6.1 Introduction

Physical Infrastructure mainly comprises of five major components *viz.* Water Supply System, Sewerage System, Drainage System, Solid Waste Management and Power Supply. Water Supply System deals with the transportation of safe drinking water to every household connected within the system. Sewerage System deals with the efficient disposal of human waste without harming the ecological system of the region. This also ensures that human health is not affected by diseases like Hepatitis, Cholera, Diarrhoea, Typhoid, and other parasitic infections which are every common and can easily be spread due to inadequate treatment of effluent. Drainage System deals with the effective channelling of wastewater from the household and runoffs from road and open areas. Well organised drain lines can even prevent flooding and water logging issues and can be used as a source of raw water for the Water treatment Plant and irrigation purposes. Solid Waste management deals with the various categories of waste generated by the humans. These wastes are transported, segregated, and processed by land filling or incineration which are not the best methods as excessive land filing leads to degradation of soil fertility and can even pollute ground water due to seepage. Power supply deals with the source of power generation, mode of transportation and consumption.

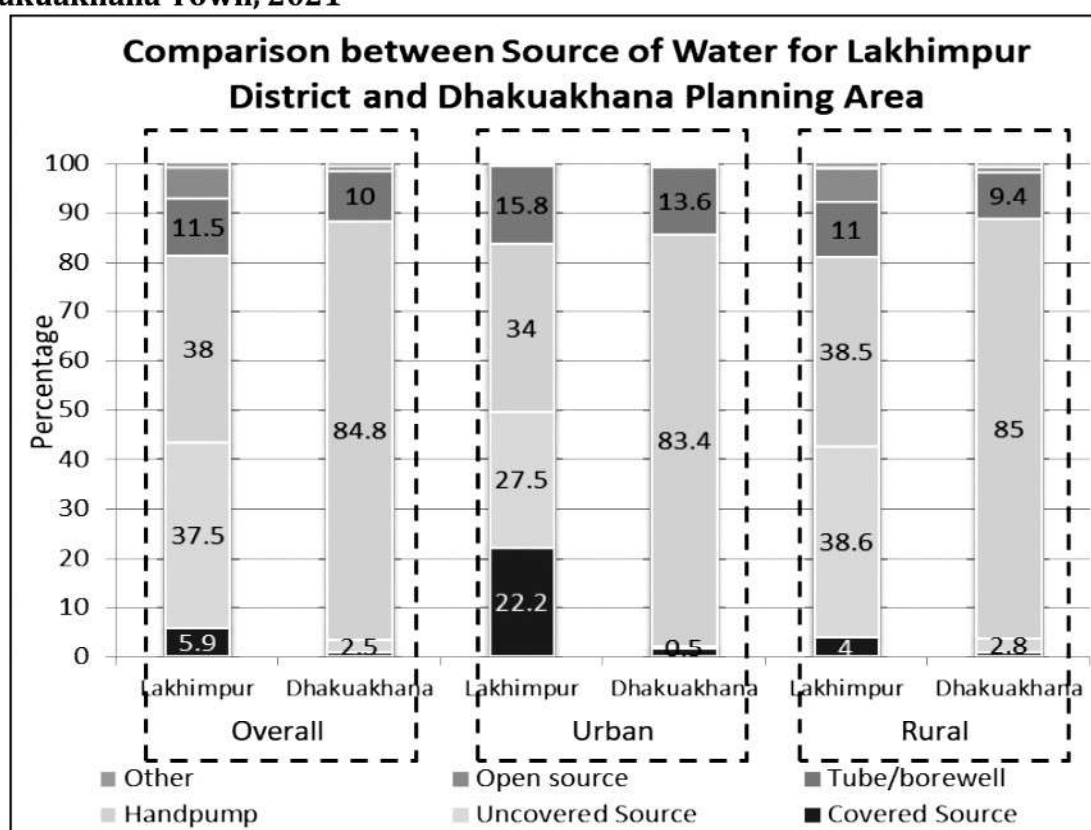
6.2 Water Supply in Dhakuakhana Town

For the analysis of Water Supply in Dhakuakhana Town the analysis is simplified as, treated tap water and covered wells are considered as covered source of water which is safe from the foreign particulates and matters which can result in degradation of water quality. Tap water from untreated source and un-covered wells are considered as uncovered source of water as these sources are vulnerable to foreign contaminants which can result in degradation of water quality. Open sources are the combination of water from spring, river, canal, tank, pond and lake.

According to Census of India 2011, dependency on Hand-pump is 84.8 percent for Dhakuakhana Revenue Circle which is about twice to that of Lakhimpur District. The same figures are reflected when consideration is done for the urban and rural context.

83.4 percent and 85 percent of household in urban and rural Dhakuakhana are dependent on Hand-pumps respectively. When covered water source is compared, 22.2 percent of urban household in Lakhimpur District suffice their water demand from a covered source, in comparison only 0.5 percent of household in urban areas of Dhakuakhana suffices their water demand from the same. This condition may lead to depletion of ground water table and result in scarcity of water in the future as the dependency on ground water is 97 percent in Dhakuakhana town. The similar condition is reflected in the rural areas of Dhakuakhana where 94.4 percent of household is dependent upon ground water. However, this condition is better than the rural areas of Lakhimpur district where 45.5 percent of household are dependent upon uncovered or open source (see Figure 6.1). This indicates that their needs an extensive development for potable water supply for both Dhakuakhana town and Lakhimpur district.

Figure 6.1: Sources of Water for Domestic Use in Lakhimpur District and Dhakuakhana Town, 2021



Source: Census of India (2011).

6.2.1 Demand Gap for Potable Water in Dhakuakhana Town

According to Census of India 2011, population of Dhakuakhana town is 13,502 and total population within planning area is 31,557. As per Central Public Health Environmental

Engineering Organization (CPHEEO) manual on Water Supply and Treatment 1999, recommended maximum water supply for a town with piped water supply without sewerage network should 70 litres per capita per day (lpcd) hence the total water demand is calculated as 2.20 million litres per day (MLD). Since there is no provision of potable water supply in Dhakuakhana town, the total water demand is calculated as 2.20 MLD. Considering 20 percent losses which include transmission loss, theft and leakages, the actual water demand is calculated to be 2.64 MLD and the actual gap will be 2.64 MLD. According to the CPHEEO 1999 guidelines, the fire demand for a town can be calculated with the formulae $100\sqrt{P}$ where P is population. Hence, the fire demand is calculated as 0.02 MLD (**see Table 6.1**). Hence the total water demand gap for Dhakuakhana town is calculated as 2.66 MLD.

Table 6.1: Demand Gap for Water Supply in Dhakuakhana Town, 2011

Total Population of Dhakuakhana Planning Area	31,557
Per Capita Water Demand (in LPCD)	70.00
Total Water Demand (in MLD)	2.20
Transmission and other losses in Percent	20.00
Total Losses (in MLD)	0.44
Fire Demand (in MLD)	0.02
Actual Water Demand (in MLD)	2.66
Existing Supply (in MLD)	-
Demand Gap (in MLD)	2.66

Source: SPA Delhi (2022).

As dependency on hand pump is 84.8 percent in Dhakuakhana, the condition of these hand pumps and surrounding areas should be well maintained as pollutants around hand pump can lead to contamination of potable water. From primary survey, it was found that most of the hand pumps in urban areas are not maintained and are at unhygienic conditions. The picture attached in figure 2.2 depicts the unhygienic condition near a hand pump at Ward 8. Similarly figure 2.3 shows another hand pump at ward 10 with similar conditions. The condition of these hand pumps can lead to serious health hazard amongst people of Dhakuakhana town.

Figure 6.2: Condition of Hand Pump in Ward 8 and Ward 10 in Dhakuakhana Town, 2022

Source: Primary Survey, SPA New Delhi (2022).

6.2.2 Ward wise sources of Drinking Water in Dhakuakhana Town

According to Census of India 2011, the highest dependency on handpump is in ward 1 with 97.3 percent of household depending for their potable water followed by ward 2 with 94.2 percent. Ward 4 has the least dependency on hand-pump with 55.7 percent however the dependency on tube well/borehole is 41.4 percent (see Table 6.2).

Table 6.2: Main Sources of Drinking Water in Dhakuakhana Town, 2011

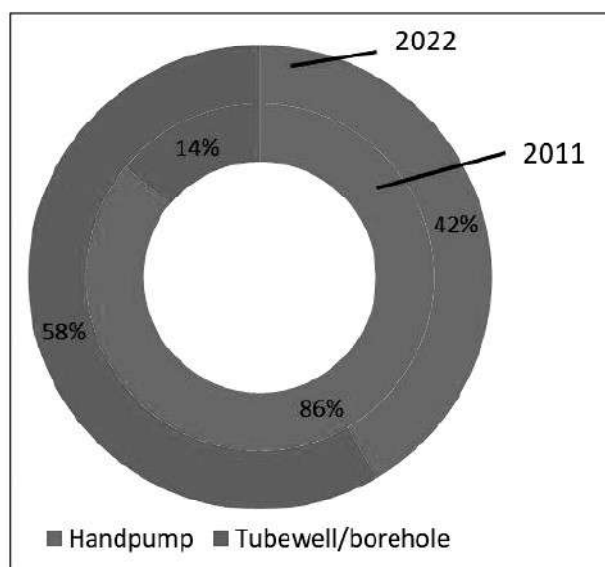
Area Name	Main Source of Drinking Water (in percent)								
	Tap water from treated source	Tap water from un-treated source	Covered well	Un-covered well	Hand pump	Tube well/Borehole	Spring	River/Canal	Other sources
Ward 1	0.8	0.3	0.0	0.8	97.3	0.8	0	0	0
Ward 2	2.6	0.0	0.2	0.4	94.2	2.3	0	0.1	0.1
Ward 3	0.1	0.6	0.3	0.0	83.6	13.6	0.1	1.5	0.2
Ward 4	2.5	0.0	0.0	0.2	55.7	41.4	0	0.2	0
Total	1.5	0.23	0.13	0.35	82.7	14.53	0.03	0.45	0.08

Source: Census of India (2011).

It was found from the primary survey that the average dependency on hand-pump has reduced from 83.4 percent in 2011 to 41.3 percent in 2022 with urban areas of

Dhakuakhana town. However, there is significant increase on the dependency of borehole which was 13.7 percent in 2011 up to 58 percent in 2022 (see Figure 6.3). Overall dependency on ground water has remained same for Dhakuakhana town and development of piped water supply is necessary to reduce exploitation of ground water sources.

Figure 6.3: Change of Main Sources of Drinking Water in Dhakuakhana Town 2011-22



Source: Census of India (2011), Primary Survey (2022).

As per the Census of India 2011, 75.5 percent of the households in Dhakuakhana town have a drinking water facility within their home while 22.5 percent of households have these facilities near their premises. Only 2.1 percent of the households still need to fetch drinking water from places away from their premises (see Table 6.3). In Ward 2 all the houses have drinking water facilities available either within the premises or near it with 96.7 percent of the houses having the facility available within the house itself. Ward 3 has the highest number of houses (6.2 percent) where the drinking water needs to be fetched from far away.

Table 6.3: Location of Drinking Water Facilities in Dhakuakhana Town, 2011

Area Name	Location of Drinking Water Sources		
	Within premises	Near premises	Away from premises
Ward 1	53.5	45.4	1.1
Ward 2	96.7	3.3	0.0
Ward 3	76.5	17.3	6.2
Ward 4	75.2	23.9	0.9
Total	75.5	22.5	2.1

Source: Census of India (2011).

According to primary survey 2022, people of Dhakuakhana town is complaining about the quality of water. 40 percent of household have responded that the quality of water is poor with high concentration of iron (Fe) content. According to Central Public Health Environmental Engineering Organization (CPHEEO) manual on Water Supply and Treatment 1999, 0.1 milligram (mg) of iron per litre of water is acceptable; value of iron content in water must not increase 1.0 mg as it may lead to health complications. High content of iron is also associated with skin issues and effect on fixtures and appliances.

6.3 Impact of Jal Jeevan Mission on Dhakuakhana Planning Area

Under the National Rural Drinking Water Programme (NRDWP) Ministry of Drinking Water & Sanitation provides technical and financial assistance to the States to provide safe and adequate drinking water to the rural population. The Ministry of Drinking Water & Sanitation under the scheme '*Jal Jeevan Mission*' (JJM) has prepared a Strategic Plan for coverage of rural households with Piped Water.

According to E-Jalshakti portal 2022, Lakhimpur district has 42 percent of household connected with tap water supply in rural regions. In Dhakuakhana planning area there are 24 villages within planning boundary. Of these villages only six villages have 100 percent household connected with tap water supply viz. Bahpara village, Narayanpur Chapari, Dunia Perabari, Bantow Goan, Kalakata Chetia and Gohain Handique. However, none of these villages are '*Har Ghar Jal*' certified. Villages with more than 50 percent household connected with tap water are Dighala Chapari (85.09 percent), Dighala Hiloidari (67.53 percent), Barhula Chapari (56.36 percent) and Jiamoria Goan (51 percent). No data is available for Bantow Chamuah Pathar village, Bantow Pathar, Gohain Bari and Kuhimari Chapari village is uninhabited. 10 villages are completely deprived of JJM (see Table 6.4).

Table 6.4: Villages with Household Connected with Tap Water under JJM, 2022

S. No.	Name of Village	No. of Households	Percent of Household Connected with Tap Water
1.	Bahpara	205	100
2.	Bantow Chamuah Pathar	70	N.A.
3.	Bantow Gaon	565	100
4.	Bantow Pathar	38	N.A.
5.	Borhola Chapari	2	0
6.	Bhalukguri Chapari	56	56.36

S. No.	Name of Village	No. of Households	Percent of Household Connected with Tap Water
7.	Dakhin Chapari	27	0
8.	Dighala Chapari	55	85.09
9.	Dighala Hiloi Dhari	543	67.53
10.	Dullapara Bhari	203	100
11.	Gohain Bari	185	N.A.
12.	Gohain Bari Pathar	130	0
13.	Gohain Handique	344	100
14.	Jarani Chapari	19	0
15.	Jiamoria Gaon	507	51
16.	Kalakata Chetia	295	100
17.	Kuhimari Chapari	0	-
18.	Narayanpur Chapari	49	100
19.	N.C. Bantow	12	0
20.	N.C. Simaluguri	135	0
21.	No.1 Ghilaguri	98	0
22.	No.2 Ghilaguri	16	0
23.	Pithiyal	287	0
24.	Teliachapari	25	0

Source: E-Jalshakti Portal (2022).

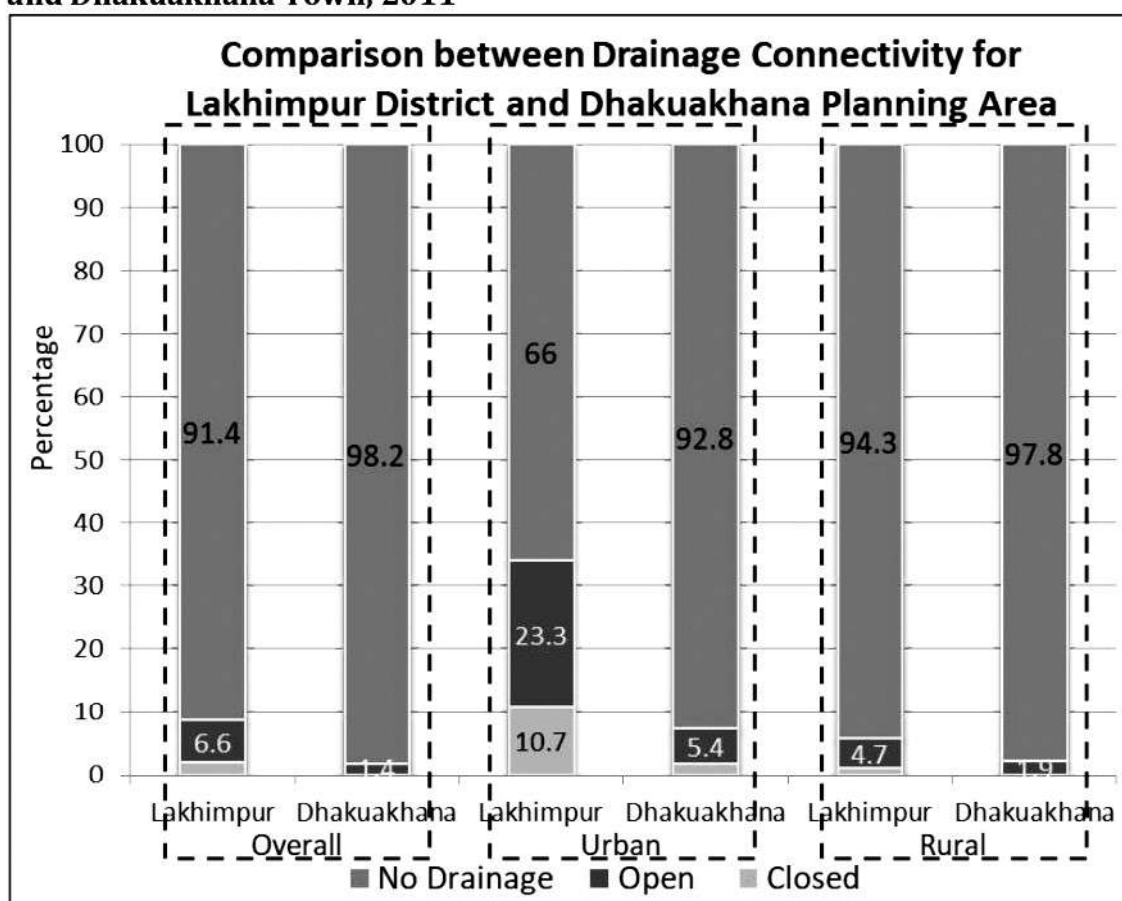
6.4 Drainage Network in Dhakuakhana Town

According to CEEW report on Mapping India's Climate Vulnerability 2021, Lakhimpur district ranks tenth in the most vulnerable district of India to face severe flood issues and thus extensive development at drainage front is necessary to avoid water logging issues within the district. However, 91.4 percent of households in Dhakuakhana are not connected to any drainage network and only 6.6 percent of household are connected to open drains. The condition in Dhakuakhana Revenue Circle is even poor with 98.2 percent of households not having any drainage facilities. In the urban context, urban areas of Lakhimpur District have 34 percent of households connected to open (23.3 percent) and closed (10.7 percent) drains with 66 percent households remaining to be connected to drainage network. In comparison, Dhakuakhana town only has 7.2 percent of households connected to drainage line with distribution of 5.4 percent household connected to open drain and only 1.8 percent household connected to closed drains (see Figure 6.4).

According to India Meteorological Department 2019, average annual rainfall in Lakhimpur district is 2,810 mm with rain-day of 217.2 days. As per land use of

Dhakuakhana planning area, the total built-up in Dhakuakhana planning area is 5.97 sq km and the total area within Planning Boundary is 60.97 sq km. The maximum rainfall recorded at Dhakuakhana is 1,445.21 mm for 29 days in the year of 2015, which is 49.83 mm or 1.96 inches per day. To calculate peak storm water discharge, formulae of discharge is used which is a product of coefficient of runoff (C), catchment area and rainfall intensity. C is taken as 0.45 for open fields and 0.75 for built-up or constructed area. Hence peak storm water discharge is calculated as 60,683.59 cubic meters per hour for Dhakuakhana Planning area. Considering storage capacity of the drainage network to be 15 minutes, the drainage system should be designed to store a volume of 15,170.90 cubic metres.

Figure 6.4: Households Connected with Drainage Network in Lakhimpur District and Dhakuakhana Town, 2011



Source: Census of India (2011).

For an effective drainage solution for a region, segregated connection of households with drain lines will lead to even bigger challenge as runoff from the household connected with drains will impact the places which does not have any connectivity to the drainage network creating waterlogging at the lower levels of the town.

6.4.1 Existing Situation of Drainage in Dhakuakhana Town

According to Census of India 2011, 93.25 percent of households do not have a drainage connection of any sort. Only 6.74 percent of the households have a drainage connection out of which 4.8 percent are open drains and merely 1.87 percent of households have closed drains (**see Table 6.5**). In Ward 1, about 99.5 percent of the households are without a drainage connection. Out of the few areas of the town where drains are present, the maximum percentage of closed drains is in Ward 4 (4.6 percent). Ward 2 has the maximum number of households with open drains.

Table 6.5: Drainage Connectivity to Wastewater Outlets in Dhakuakhana Town, 2011

Area Name	Wastewater outlet connected to		
	Closed drainage	Open drainage	No drainage
Ward 1	0.0	0.5	99.5
Ward 2	1.6	8.4	90.0
Ward 3	1.3	3.6	95.1
Ward 4	4.6	7.0	88.4
Total	1.88	4.88	93.25

Source: Census of India (2011).

The conditions of existing drains are very poor in Dhakuakhana town as shown in the figure taken during primary survey. These drains are unscientifically designed with dirt and solid waste accumulating in the drain leading to water logging issue at various locations. As these drains are open, people of town tend to throw their waste on these open drains which leads to clogging (**see Figure 6.5**)

Figure 6.5: Condition of Drains in Dhakuakhana Town, 2022

Source: Primary Survey, SPA New Delhi (2022).

Charikariya River which passes within Municipal Boundary is the main natural drain in Dhakuakhana town. Karha River is another natural drain passing through planning area which caused massive destruction during the year 1998 and 2008. Hence, special attention is required on the development of drainage network in Dhakuakhana Town as rainwater runoff cannot be directly disposed on these natural drains as it may cause flood like situations in the lower regions of the town.

6.5 Conclusions

Existing water supply and Drainage network has been studied in this chapter. Dhakuakhana town needs extensive development in the field of potable water supply as continuous dependency on ground water may lead to reduction of water tables. The quality of ground water is reported to be high on iron concentration which may lead to health issues. The surrounding areas of hand pump needs to develop for better hygienic conditions. Comprehensive drainage plan for the development of effective drainage network is essential for Dhakuakhana town as the existing drains are in very poor condition due to clogging because of dumping of Solid wastes. Water logging issues have been received from many regions of the Dhakuakhana town.

CHAPTER 7: SANITATION

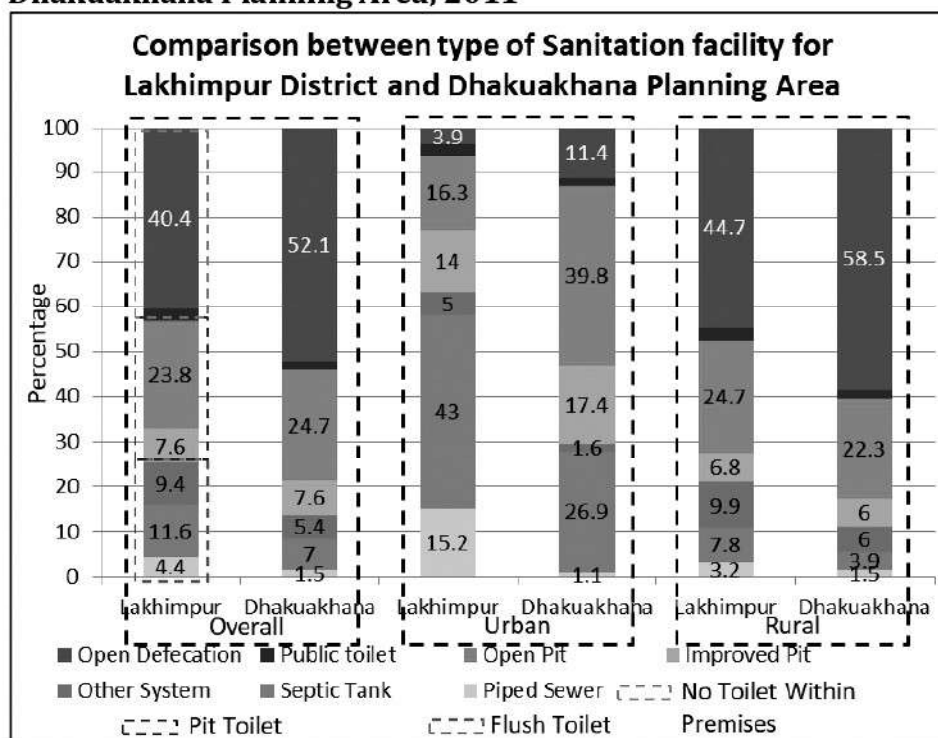
7.1 Introduction

Sanitation refers to treatment and safe disposal of human excreta and sewage. Public health risks are associated with mismanagement of fecal waste, black and grey water. According to census data of India 2011, only 4.4 percent of the households were connected to piped sewer lines in Lakhimpur District and only 11.6 percent of the households had septic tank connection. 9.4 percent of household had other system of disposing night soil combining flush toilets to be 25.4 percent. In comparison, Dhakuakhana planning area has only 1.6 percent of households connected to sewer lines while seven and 5.4 percent rely on septic tank and other system to dispose sewage for a combined total of flush toilet to be 13.9 percent which is significantly below than the district average. Dependency on pit toilets is significant in Lakhimpur district as 31.4 percent of the household rely on pit mechanism of which only 7.6 percent are improved pits while 23.8 percent are open pits. 43.2 percent of the households in Lakhimpur district does not have toilet facility of which only 2.8 percent household used community toilets while 40.4 percent were practicing open defecation. In comparison, 53.8 percent of households in Dhakuakhana planning area do not have toilet facility within the premises of which only 1.7 percent of households used community toilets and 52.1 percent of households practiced open defecation. The overall comparison of Dhakuakhana planning area signifies that sanitation facility were below the district average (**see Figure 7.1**).

Sanitation facility in urban regions of Lakhimpur District has 63.2 percent of households having flush toilet facility of which 15.2 percent have piped sewer connectivity, 43 percent household use septic tank while five percent households use other system for disposal of sewerage. In comparison, Dhakuakhana town has 29.6 percent of households connected to flush toilets of which 1.1 percent are connected to piped sewers, 26.9 percent of households are equipped with septic tank and 1.6 percent households use other mechanism. 30.3 percent of households in urban Lakhimpur are dependent on pit system for sanitation of which 14 percent are improved pits while 16.3 percent of households have open pit system. Households in Dhakuakhana town have much higher dependency on pit system with 17.4 percent of households having

improved pit system while 39.8 percent have open pit system for a combined percentage of 57.2 percent in urban regions. The district average for households without sanitation facility is 6.5 percent of which 3.9 percent practice open defecation while in Dhakuakhana town, 11.4 percent of households practice open defecation (see Figure 7.1).

Figure 7.1: Households with Type of Sanitation Facility in Lakhimpur District and Dhakuakhana Planning Area, 2011



Source: Census of India (2011).

In the rural regions of Lakhimpur District, only 3.2, 7.8 and 9.9 percent of households are connected with piped sewer, septic tank and other flush systems respectively for a combined flush system of 20.9 percent. For Dhakuakhana, the averages are 1.5, 3.9 and six percent respectively. In Lakhimpur District, 31.5 percent of households depend upon pit system of which 6.8 percent is improved pit while 24.7 percent are open pit. In comparison, Dhakuakhana has 28.3 percent of household connected to pit system of which six percent are improved pit while 22.3 percent are open pit. The average number of households in rural region not having any sanitation facility in Lakhimpur District is 47.6 percent of which only 2.9 percent of household use community toilet while 44.7 percent household practiced open defecation. The numbers slide in rural Dhakuakhana with 58.5 percent of household practicing open defecation while 1.8 percent household use community toilet (see Figure 7.1).

7.2 Existing Situation of Sanitation in Dhakuakhana Town

In Dhakuakhana town, nearly 87.03 percent of the households have a latrine facility within their premises as per the Census of India, 2011. The maximum number of toilets in the town are pit latrines (58.73 percent) followed by flush-type toilets (28 percent). Only 0.23 percent of the houses in the town have service latrines (see Table 7.1).

Table 7.1: Availability and Types of Toilet Facility in Dhakuakhana Town, 2011 (in percent)

Area Name	Households having latrine facility within the premises	Households not having latrine facility within the premises	Flush and pour flush latrine	Pit latrine	Service latrine
Ward 1	94.1	5.9	17.8	76.2	0.0
Ward 2	99.6	0.4	39.8	59.6	0.2
Ward 3	81.2	18.8	25.0	56.1	0.2
Ward 4	73.2	26.8	29.7	43.0	0.5
Total	87.03	12.98	28.08	58.73	0.23

Source: Census of India (2011).

Ward level break up of toilet facilities are given in Table 7.2. About 42.32 percent of the pit latrines are of the open-pit latrine which does not have a permanent slab. Only 16.4 percent of the pit latrines have a slab or a ventilated improved pit. 25.6 percent of the flush latrines have a septic tank. Only 1.1 percent of the flush latrines have a piped sewer system. Out of the very few service latrines that the town has, all of them have their night soil being disposed into an open drain. There are no service latrines that have their night soil serviced by humans or animals.

Table 7.2: Type of Toilet Facilities in Dhakuakhana Town, 2011

Area Name	Flush/pour flush latrine connected to			Pit latrine		Service Latrine	
	Piped sewer system	Septic tank	Other system	With slab/ventilated improved pit	Without slab/open pit	Night soil disposed into open drain	Night soil serviced by animal
Ward 1	0.5	16.8	0.5	13	63.2	0	0

Area Name	Flush/pour flush latrine connected to			Pit latrine		Service Latrine	
	Piped sewer system	Septic tank	Other system	With slab/ventilated improved pit	Without slab/open pit	Night soil disposed into open drain	Night soil serviced by animal
Ward 2	1.2	38.2	0.4	15.6	44	0.2	0
Ward 3	0.9	21.3	2.8	20.8	35.3	0.2	0
Ward 4	1.8	26.1	1.8	16.2	26.8	0.5	0
Total	1.1	25.6	1.38	16.4	42.33	0.23	0

Source: Census of India (2011).

As per the Census of India, 2011, nearly 13 percent of the households do not have a latrine facility within their premises in Dhakuakhana town. The alternative sources of defecation in the town are public latrines and open defecation. Nearly 1.75 percent of the households utilize public latrines and the rest 17.3 percent of the households' resort to open defecation (**see Table 7.3**). Ward 4 has the highest number of households not having a latrine facility within the premises amounting to nearly 26.8 percent of its total households. This is followed by Ward 3 where nearly 18.8 percent of the households do not have a latrine facility within the premises. Ward 2 has only 0.4 percent of the houses not having a latrine facility within the premises. Ward 4 and 3 are also the wards with the highest number of open defecation cases amounting to nearly 21.2 percent and 17.3 percent respectively. Ward 2 has the least number of open defecation cases followed by Ward 1, with only 0.4 percent and 5.9 percent open defecation cases respectively.

Table 7.3: Alternative Sources of Defecation in Dhakuakhana Town, 2011

Area Name	Households not having latrine facility within the premises	Alternative source	
		Public latrine	Open
Ward 1	5.9	0.0	5.9
Ward 2	0.4	0.0	0.4
Ward 3	18.8	1.5	17.3
Ward 4	26.8	5.5	21.2
Total	12.98	1.75	11.2

Source: Census of India (2011).

7.2.1 Impact of Swachh Bharat Mission on Sanitation in Dhakuakhana Town

According to Municipal Board of Dhakuakhana town, under Swachh Bharat Mission (SBM), 1,261 numbers of individual household latrines (IHHL) has been constructed with septic tank, which was the initial target and hence Dhakuakhana town has been declared as Open Defecation Free (ODF) city. As the population of Dhakuakhana planning area is 31,557, a sewerage network may not be an effective way of disposal of night soil as its operation and maintenance will not be financially feasible. Dhakuakhana town is not equipped with fecal sludge treatment plant (FSTP) currently, hence a treatment plant with capacity of 2.13 million liters per day (MLD) is required since the total water demand is 2.66 MLD therefore by conversion factor of 80 percent required capacity of FSTP is calculated.

7.3 Conclusions

Sanitation facilities of Dhakuakhana town have been analyzed in this chapter. Till, 2011 open defecation was more than 50 percent however, after introduction of Swachh Bharat Mission in 2015, drastic improvement has been noticed within Dhakuakhana town and hence the town has been declared open Defecation free. There is a requirement of one Fecal Sludge Treatment Plant with capacity of 2.13 MLD for the treatment of night soil which is now disposed openly.

CHAPTER 8: SOLID WASTE MANAGEMENT AND POWER

8.1 Introduction

Solid waste management and continuous power supply are the necessity of humans in a developed society. It is of utmost importance for an administration to provide these facilities or help people who are lacking behind, for the balanced and sustainable growth of the society. Solid waste management (SWM) has emerged as one of the most massive development challenges in urban India. Numerous studies indicate that the unsafe disposal of waste generates dangerous gases and leachates, due to microbial decomposition, climate conditions, refuse characteristics and land-filling operations. According to the 12th Schedule of the 74th Constitution Amendment Act of 1992, urban local bodies (ULBs) are responsible for keeping cities and towns clean. However, most ULBs lack adequate infrastructure and face various strategic and institutional weaknesses, such as poor institutional capacity, financial constraints, and a lack of political will. While many Indian ULBs do receive government assistance, almost all of them continue to be financially fragile. India has already exhausted all available landfill sites, and the concerned ULBs do not have resources to acquire new land. Moreover, finding new landfill sites is a difficult task as local officials are averse to setting aside land in their jurisdiction for waste that come from other areas.

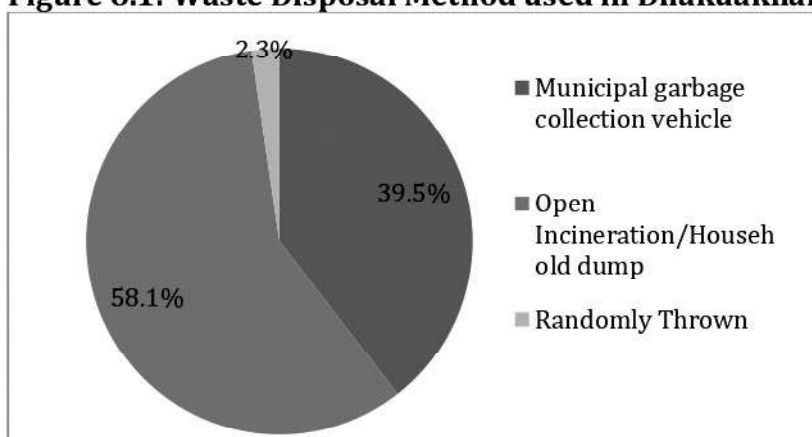
In this chapter, existing solid waste management practices in Dhakuakhana has been discussed. The existing provisions and practices of solid waste management are assessed with respect to the benchmarks set by Ministry of Urban Development (MoUD) and sector specific policies of Government like Municipal Solid Waste Rules, 2016 and Assam Solid Waste Management Policy, 2018. The gap in the existing practices and provisions is identified. In the end, interventions, and strategies are suggested to tackle the challenges in this sector.

8.2 Solid Waste Management in Dhakuakhana Town

There is no data available for waste generation in Dhakuakhana town therefore it has to be estimated. The Per capita waste generation for the town, as per Proposal for Rehabilitation of Legacy Municipal Solid Waste at Dumpsite and Fresh Municipal Solid Waste 2021, is 0.3 kg waste per day. So, the estimated waste generation for

Dhakuakhana Planning area is 9.46 tonnes per day. The collection of waste is done by Municipal Board of Dhakuakhana town via cycle rickshaw which are equipped with waste bins for wet and dry waste. However, only 39.5 percent of household is using this facility and 58.1 percent of households dispose their waste either by open incineration or disposing on drenches and 2.3 percent of household practice randomly throwing their waste (see Figure 8.1).

Figure 8.1: Waste Disposal Method used in Dhakuakhana Town, 2022



Source: Primary Survey, SPA New Delhi (2022).

Even in public spaces, open incineration of solid waste is prominent as shown in Figure 8.2.

Figure 8.2: Burning of Solid Waste in Public Space in Dhakuakhana Town



Source: Primary Survey, SPA New Delhi (2022).

There is a dumb site at Ward 2 of area 0.3 Ha however, waste is unscientifically incinerated openly. This is a very hazardous practice as it not only damages the air

quality of the town; it may also lead to health hazard to the people of Dhakuakhana town. The location of the dumpsite is only 85 metres from Charikariya River which is a matter of concern as the pollutants from the dumpsite can pollute the nearby water body. During primary survey it was also observed that solid wastes were found at the banks of Charikariya River (see Figure 8.3).

Figure 8.3: Waste Disposal along Charikariya River, Waste Disposal Site



Source: Primary Survey, SPA New Delhi (2022).

According to Municipal Board of Dhakuakhana, under *Swachh Bharat Mission (Urban)*, one Cesspool Cleaner is functional in Dhakuakhana town. One Composting Machine and one Plastic Shredding Machine has also been delivered to Municipal Board however, their installation is still pending. Four new Machineries have also been ordered which includes two Hydraulic trolley tractors mounted, one open drain cleaning machine and one stainless steel hydraulic dustbin; however, these machines are yet to be delivered and their operations will take time. These machines will reduce the burden of Solid Waste from Dhakuakhana town; however, proper Solid Waste Management Plan needs to be developed for safe disposals of Solid Waste.

8.3 Power

In Dhakuakhana town, the maximum numbers of households use electricity as a source of lighting which amounts to nearly 64.95 percent of the total households as per the census of India 2011. About 34 percent of households use kerosene as a source of lighting. A negligible percentage of houses use solar energy or any other source of lighting. There are no households in the town that do not have access to any kind of source of lighting (see Table 8.1).

Table 8.1: Sources of Lighting in Dhakuakhana Town, 2011

Area Name	Main Sources of Lighting				
	Electricity	Kerosene	Solar energy	Other oil	Any other
Ward 1	50.5	49.5	0	0	0
Ward 2	79.1	20.9	0	0	0
Ward 3	63.8	36.0	0.2	0	0.1
Ward 4	66.4	33.4	0	0.2	0
Total	64.95	34.95	0.05	0.05	0.03

Source: Census of India (2011).

As per the data received from Assam Power Distribution Company Limited, the electricity department of Dhakuakhana, the yearly electricity demand has been constantly increasing. In the year, 2015 the town required 5 M.W of electricity. In 2021, the demand has gone up to 7.2 MW (see Table 8.2). The Electricity Department at present has been able to fulfil this demand without any hassle. The major source of electricity in Dhakuakhana is the 132/33 kV GSS under Assam Electricity Grid Corporation Limited at Hatigarh.

Table 8.2: Electricity Demand in Dhakuakhana Town, 2015-2021

Total electricity demand in MW	2015	2016	2017	2018	2019	2020	2021
	5.0	5.3	5.4	6.1	6.6	6.9	7.2

Source: APDCL, Dhakuakhana (2022).

The number of electrified households in each ward has also grown over the past five years. Ward 10 has the largest number of electrified households at present followed by Ward 7, having 420 and 400 households respectively. In the town, the total number of electrified households has also grown from 2,851 in 2015 to 3,391 households in 2021 with an average increase of 90 households per year (see Table 8.3).

Table 8.3: Electrified Households in Dhakuakhana Town from, 2015-2021.

Area	Year						
	2015	2016	2017	2018	2019	2020	2021
Ward 1	203	216	223	226	246	254	257
Ward 2	231	244	251	254	271	276	285
Ward 3	252	265	272	275	291	299	306
Ward 4	303	316	323	326	342	350	357
Ward 5	307	320	327	330	350	358	361
Ward 6	286	299	306	309	322	335	340
Ward 7	346	359	366	369	386	394	400
Ward 8	312	325	332	335	350	361	366
Ward 9	245	258	265	268	287	295	299
Ward 10	366	379	386	389	398	411	420
Total	2,851	2,981	3,051	3,081	3,243	3,333	3,391

Source: APDCL, Dhakuakhana (2022).

8.4 Conclusions

Solid Waste Management and power supply has been analyzed in this chapter. Power sector has noticed significant development as during 2011, only 65 percent of households were electrified which increased to 100 percent during 2022. Total electricity demand was 7.2 Megawatt for year 2021.

Solid Waste Management needs special attention in Dhakuakhana town as the methodology used for the disposal of solid waste is unscientific and generally incineration is the most prominent method. Current waste dump site is only 85 metres from Charikariya River which can lead to pollution of river body hence, relocation of the dumpsite is necessary. More than 58.1 percent of household practices open incineration of solid waste. Even in public spaces, open incineration is prominent in Dhakuakhana town.